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Porcelain Mold Making.

BY JACOB HENNY.

[The following article by the foreman mold-maker of the General Electric Company's Works, at Schenectady, N. Y., relates to what is practically a new art—one of many to which the construction of electrical machinery has given rise. Porcelain manufacture is, of course, an old art, but until the demands for switch blocks and other insulating devices arose, the articles made of it were comparatively simple. The insulating properties of porcelain, together with its mechanical properties, make it a valuable material for the electrician; but the articles required by him are often of decidedly complicated shape, and the art of mold making for their manufacture had to be developed. Their process of manufacture is, of course, largely the same as die-sinking, although cores, loose pieces, etc., give also a semblance to patterns and core boxes. The molds when made are of a high degree of interest to any mechanic, being about the finest work of the die-sinking class that we have ever seen; many of them being, in fact, absolute works of art. Of their nature in this respect, elevations and sections can of course give no adequate idea. So far as we are aware, this is the first article upon this subject that has appeared in print.—Ed.]

The rapid advance in the uses of electricity has produced a great and growing demand for various articles of manufacture, technically known as insulations. These are very numerous, all varying in size and shape, with a difference in weight from ¼ ounce to 12 pounds, and are made of several compounds, among which is porcelain.

The General Electric Company, at their works at Schenectady, N. Y., have special departments where such pieces, in immense quantities and of every variety, are made. The intent of this letter is to briefly describe one of their processes for making porcelain insulation.

Such pieces are molded in steel dies, or molds, operated upon by the pressure of a vertical hand, screw or lever press. These dies conform in every particular to the required article, so that the molding may be complete in one operation. The making of these dies requires great ingenuity and skill, so that they will be of the required shape, and will at the same time give proper allowance for "shrinkage" in baking, which varies more or less,

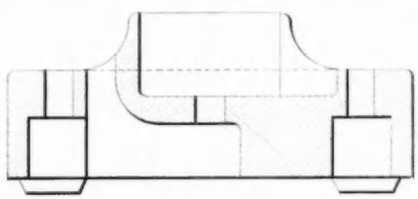

Fig. 1

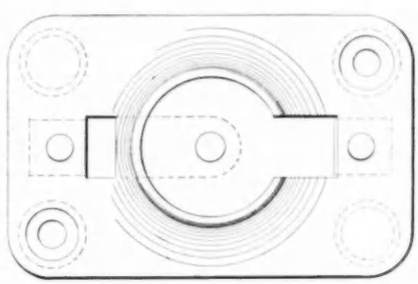

Fig. 2

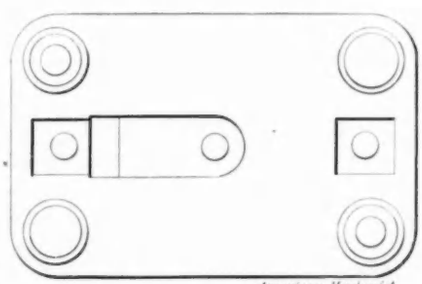

Fig. 3

THE PORCELAIN PIECE.

according to the shape or density of the piece. The shape of these dies must necessarily be the reverse from the finished product.

In the case of the piece to be described, two dies are used, one a male, the other a female; the former being the moving or pressure die, the latter the matrix, which is also movable. Fig. 1 is a section, Fig. 2 a plan and Fig. 3 a reversed plan of the under side of a porcelain piece of simple form. Fig. 4 is a section of the male die, conforming in shape to the under part of the piece, *A* being the tapered shank which fits the reciprocating spindle of the press. Fig. 5 is a section of the female die and its several connections. *B* is a shoe attached to the fixed table of the press; *C* the female die, conforming in shape to the upper part of the piece. This die is fastened by two or more pins *D D* to a lifting plate or crosshead *E*, the pins passing through a guide or bottom plate *F*, bolted to the shoe *B*, to which are attached pins or rods *G G G*, which act as cores for making the necessary holes or perforations. This lifting plate *E* is fastened to the central pin *H* of a treadle or other suitable lifting device.

The method of working is as follows, viz.: The female die being in position, the proper amount of clay, determined by weight, is placed in the cavity of the shoe; the male die is then brought down in contact therewith, by the screw or lever, to the required pressure. This being done, the male die is released clear up from the shoe, and the treadle or lifting device is then operated, carrying the female die also out of the shoe and delivering the molded piece, so that it can be removed and the process of making another insulation repeated.

After pressing, the molded piece is dried, trimmed and taken to the kiln for its first "firing."

A brief description of a kiln and the method of firing will not be out of place. Kilns are commodious in size, of a circular section, with parallel walls to a certain height and then conical up to the stack. They are internally fired at the base at several equally spaced intervals. Some have down-draft others up-draft flues, but all are so arranged that the products of combustion will pass through the interstices of the several layers of porcelain. Anthracite coal is generally used as fuel.

The filling, or charging, of a kiln requires considerable judgment and experience, so that it will hold all that it is pos-

sible, with good results, to get in, and so that there will be an even distribution of heat throughout; the largest pieces being set where the heat is the most intense. The several pieces of molded porcelain are packed in "saggars," Fig. 6, made of fire-clay and of varying depths. These are filled as full as possible, care being taken that the pieces do not touch one another. These saggars are set in the kiln, one above another, with a binder or joint ring of raw clay between each, in tiers of about 13 feet high. Fig. 7 is a section of a kiln with two tiers of saggars in position, the fire grates and flues not being shown. The life of a saggar is about five firings. The ones commonly in use are spun, or otherwise made by hand, in two pieces, a base plate and a ring, which are jointed by luting and then baked. This method causes great inequalities in hight, etc., and in packing a kiln, the saggars being thus more or less not "true," the tiers get out of line, thus endangering stability, taking up unnecessary room and causing leaks. This condition will be seen at *O*, Fig. 7.

Mr. August Webber, of Schenectady, has devised a new process for making saggars. He makes them in one piece, with good fillets in the corners. (See Fig. 8.) His process obviates all previous difficulties, increases the life of a saggar 25 per cent., and gives 10 per cent. increase in the yield of a kiln. His saggars being practically true, fit in perfect line. (See *N*, Fig. 7.)

By this process of "first firing," the pieces of porcelain are vitrified throughout. Such is essential to an insulation, for if proper vitrifaction is not attained, there would be leakage of the electrical current, causing the piece to be valueless. After this process, the pieces are taken from the kiln, receive their coating for "glaze," and are subjected to a second "firing." In this operation they assume their well-known glossy appearance, lose their surface porosity, and are ready for use.

It may be finally added that the very best materials are required in this manufacture, as in some cases porcelain insulations are required to stand from 50,000 to 100,000 volts.

Schenectady, N. Y., Sept. 17, 1897.

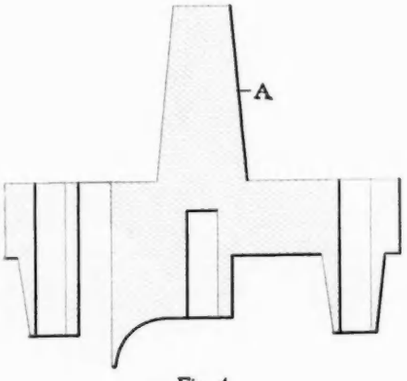

Fig. 4

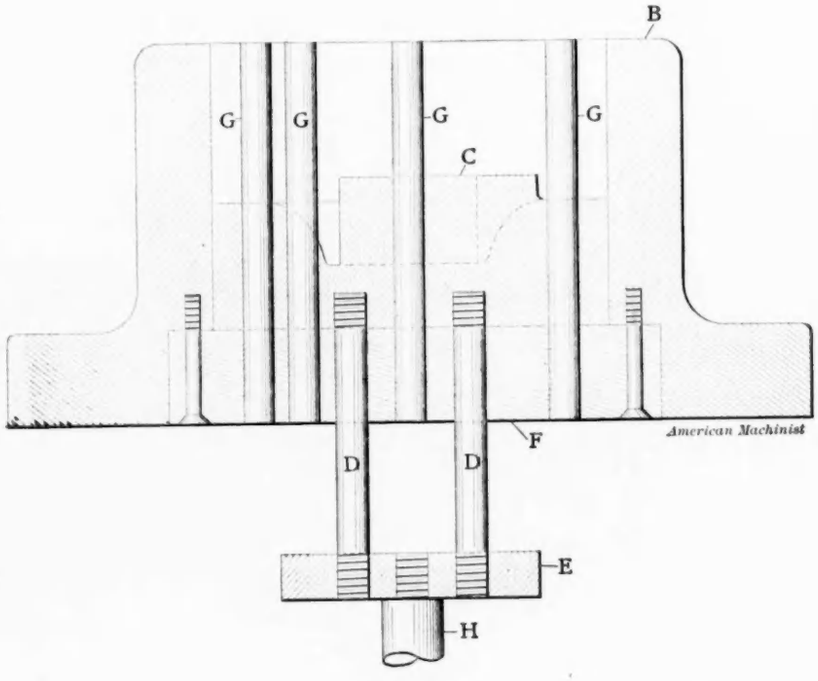

Fig. 5
THE MOLD.

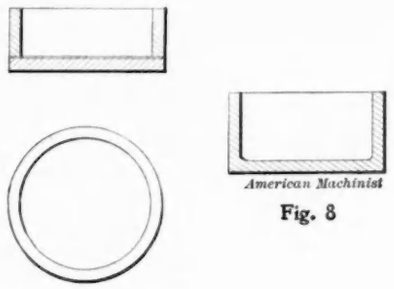

Fig. 8

Fig. 6
"SAGGARS."

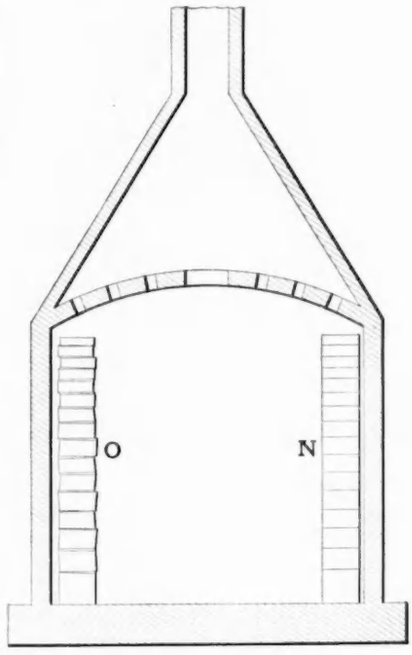

Fig. 7
PORCELAIN KILN.

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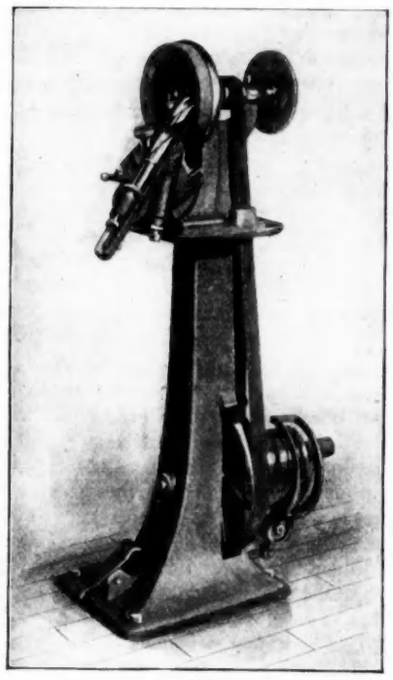
In previous issues we have referred to the very remarkable performance made by engine No. 1027, of the Atlantic City Railroad, which ran last summer between Camden and Atlantic City, N. J. This performance is believed to be, all things considered, the most remarkable ever made by a locomotive, and those of our readers who would like a photo of the engine mounted upon a card giving particulars regarding the engine and its performance, can obtain it by addressing the United States Metallic Packing Co., Philadelphia, Pa.

A New Drill Grinder.

The Walker drill grinder is a familiar machine, and our readers will, we take it, be interested in the following description of a new machine by the same inventor, which he considers to be an important improvement upon its predecessor. We give a general view of the machine, a view of the upper portion of it from the other side and on a larger scale, and some drawings and diagrams by means of which its



construction and method of operation may be understood:

The grinding spindle *B* (Fig. 1) has a tapered front bearing with end adjustment (not shown) for wear. The rear bearing is straight, but is provided with compensating device for wear. The rear end of the spindle is fitted for the regular Walker collets for emery wheel, same as are used on the Walker universal tool and cutter grinder. One collet and a point thinning wheel, as well as the regular cup wheel, accompany each machine. It will be noticed that the spindle is cast iron and has, formed integral with it, the chuck rim B^1, supported from the periphery of the grinder flange by arms similarly to a pulley rim. This chuck embraces about ¼ inch of the cup-shaped emery wheel, which is held in place longitudinally by the nut B^3, with rectangular notches or slots B^4 for tightening it up. It will also be noticed that the drills are ground on this machine upon what is usually called the "back side" of the wheel, so that as the drill and holders are oscillated, the hand of the operator is carried outside the wheel entirely.

The principle employed in grinding drills on this machine is an old one, and one that has been abundantly proven by experience to be correct and practicable, i. e., the drill to be ground is held with its axis eccentric to the chuck first, and the end of the drill is swung past the emery wheel in such manner that the heels are ground off more than the cutting lips. It is necessary, however, that the matter of radius of clearance should be looked to, as well as the amount of eccentricity, also that the positions of the drill lips should be defined with exactness and ground to exactly the same length.

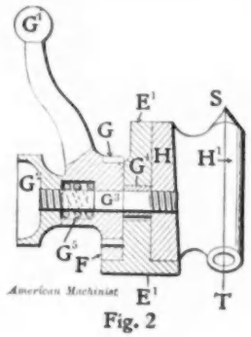


Fig. 2

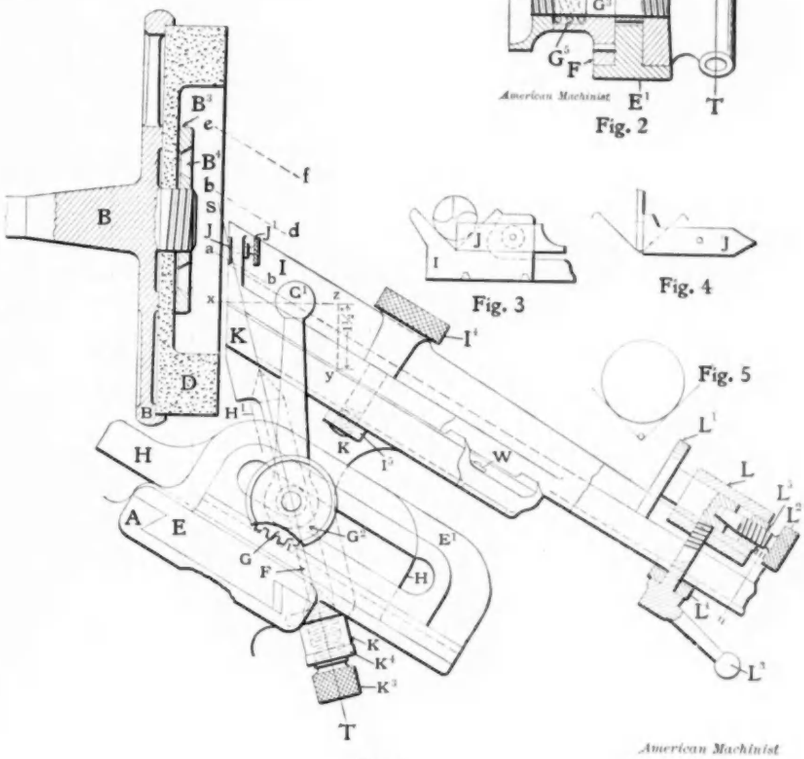


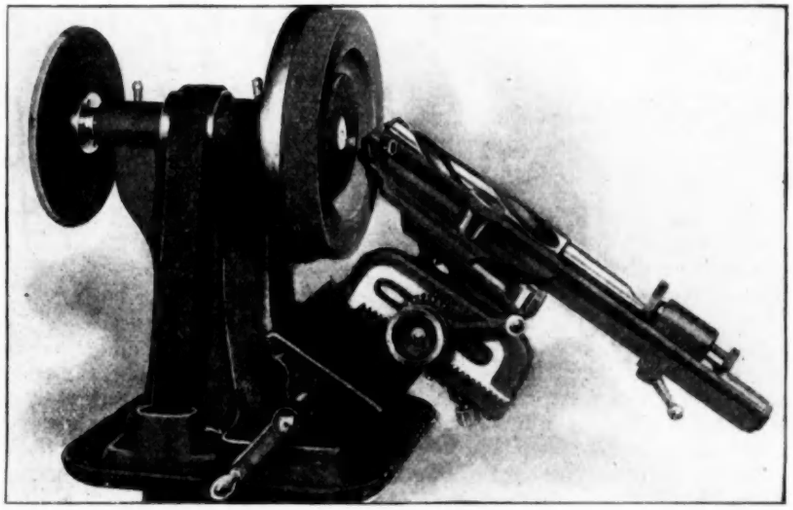
Fig. 1

SHOWING CONSTRUCTION OF DRILL GRINDER.

Fig. 3

Fig. 4

Fig. 5



The drill-holder *I* has a continuous V-shaped trough for the drills, and is slotted for a portion of its length for the screw L^3 (Figs. 1 and 7), that clamps the sliding tail stock *L*; this arrangement doing away with the necessity for a supplementary support for the drill shanks.

The drill-holder is supported on a dovetailed and gibbed cross slide *E* (Fig. 1), operated by a screw and crank. The location of this slide prevents any tilting action of the drill holder as it is moved across the wheel, and at the same time affords a rigid support nearly underneath

the grinding point. The oscillating bracket K is mounted upon the pointed pivot H^1 and is provided with an inclined tail-piece fitted with the pointed center K^3, forming the lower bearing of the pivot and providing a quick and positive take-up for wear. K^4 is a check nut. The pivot H^1 forms a part of the longitudinal

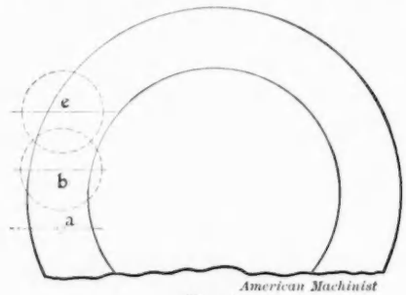


Fig. 6

slide H, supported by a projection of the cross slide E and arranged to be clamped against the vertical projection E^1 by the nut G^2 and screw stud G^3, passing through a slot in E, all as shown in Fig. 2. Upon the stud G^3 is loosely mounted the pinion G provided with a handle G^1 and being counter-bored for the spring G^5 to maintain a tension when the nut G^2 is slacked off. The pinion G is in

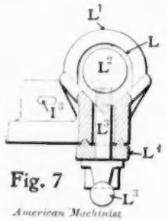


Fig. 7

mesh with the rack F fastened to the cross-slide E. Upon the stud G^3 is also loosely mounted the roller G^4, which is in contact with the upper side of the slot in E^1. This roller prevents the lifting of the slide H when adjusting it.

By means of the rack and pinion, and the clamping device, a quick and convenient adjustment of the drill and holder to and from the emery wheel is provided, this adjustment being used only in setting it in position for grinding; the feed being by means of the thumb screw L^2 in the tail stock. To provide a tension for this screw, the end of it is tapered and fits a corresponding taper in the end of the feed plunger L^1; the angle of the taper determining the friction or tension. Important advantages in the line of compactness and simplicity are attained by fitting the tail stock in the V trough and clamping same through a slot, but to prevent the trough from spreading by the wedging action in the V, the bottom of the drill holder is grooved parallel to the slot, and a bridge piece L^4, with raised ways fitting the said grooves, is provided, as shown in Fig. 7. The binding screw L^3 passes through the bridge piece, and the whole is bound firmly together.

A horizontal projection on the left-hand side of the drill-holder is also grooved upon the under side, but obliquely to the V trough (Fig. 8), and fits raised ways or shears K^1 upon the top of the oscillating bracket K, so that as the drill-holder is moved out for the larger drills, an increased eccentricity is obtained, and at the same time a longer radius of clearance; this principle being well known.

The proper angle for this oblique movement being determined, it is then necessary to provide for the proper setting of

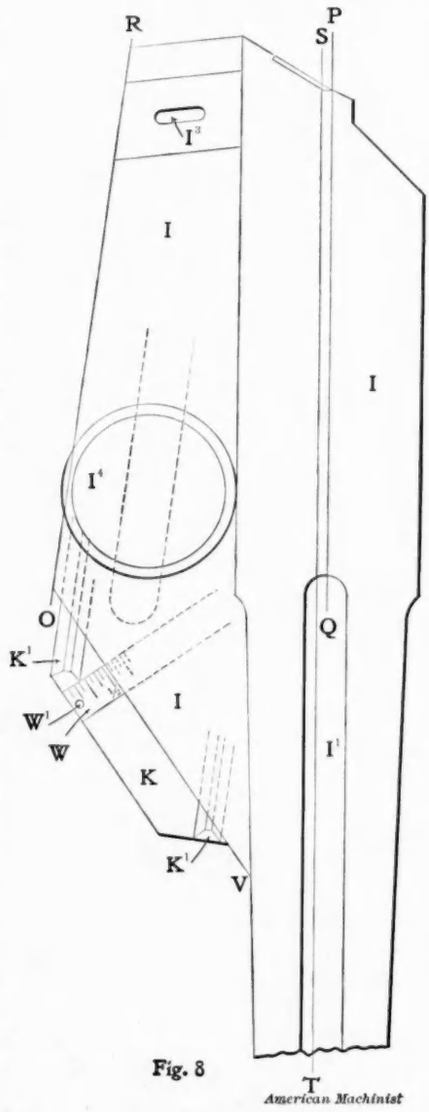


Fig. 8

the drill-holder for the various sizes of drills. It being predetermined that the drill-holder must be adjusted farther than the amount of increase in diameter of the drills, the end of the drill-holder is bevelled on the line $O\,V$, Fig. 8, to the proper angle and a standard scale of equal parts W is fastened at right angles to the end $O\,V$, upon the bracket K, the drill-holder I passing over the same, as shown in Fig. 8.

When the diameter of the drill to be ground is known, it is only necessary to set the drill-holder to the corresponding graduation of the scale; but if the size of drill is uncertain, it is first placed point downward upon the scale, and the size read at a glance; absolutely exact setting not being essential. Scales have before been employed for setting drill-holders, but set parallel with the line of movement, which necessitates having the scale with graduations coarser, and prevents the use of them for determining the sizes of the drills. An improved feature of this machine is the drill lip gage J (Fig. 4), which slides in a groove in the end of the drill-holder and is held by the knurled thumb screw J^1 (Fig. 1), passing through a slot I^3 (Fig. 8) in the drill-holder end. This lip gage is made reversible and of different shapes at the ends. In Fig. 3 is shown a lip gage for twist drills, and at the reverse end a shape to gage the teeth of a rose reamer. In Fig. 4 is shown a lip gage for setting a flat drill, or any drill with straight grooves. A further advantage of this lip gage lies in its adjustment for wear.

It will be noticed (Fig. 5) that drills of larger diameter are elevated considerably more in the V trough than the smaller ones, the diagram illustrating the difference in hight between a ⅛-inch drill and a 2-inch drill. Similarly, in Fig. 1, the line $a\,b$ represents the position of the center of a ⅛-inch drill, shown also in the diagram Fig. 6, at a. If now the drill-holder be longitudinally adjusted by means of the slide H in a horizontal direction, as is usual, the position of the center of a 2-inch drill would be in the line $e\,f$, Fig. 1, and at the point e, Fig. 6, and when ready to grind, the drill is almost out of range of the emery wheel. In the present machine the direction of movement of the slide H being inclined downward, a compensating device is formed, and in the present case the 2-inch drill centers rise only to the line $b\,d$, Fig. 1, and to the point b, Fig. 6, but slightly above the wheel center. For grinding very short drills a blocking is provided to place in the V trough in front of the tail stock plunger. The wheel stand is detachable from the column, and thus is provided a bench grinder when desired. Only one size of this machine is at present made, and it will grind drills from ⅛ inch to 2 inches diameter. It is manufactured by its inventor, O. S. Walker, Greendale, Worcester, Mass.

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A Second-Floor Blacksmith Shop.

As is well known, the Baldwin Locomotive Works is located in the heart of the city of Philadelphia, where real estate is valuable. This condition of things leads to a great many details in the construction of the works which would not be thought of under different circumstances, although, as very often happens after one has accommodated himself to circumstances in this way, the result is found to have no disadvantages, but on the

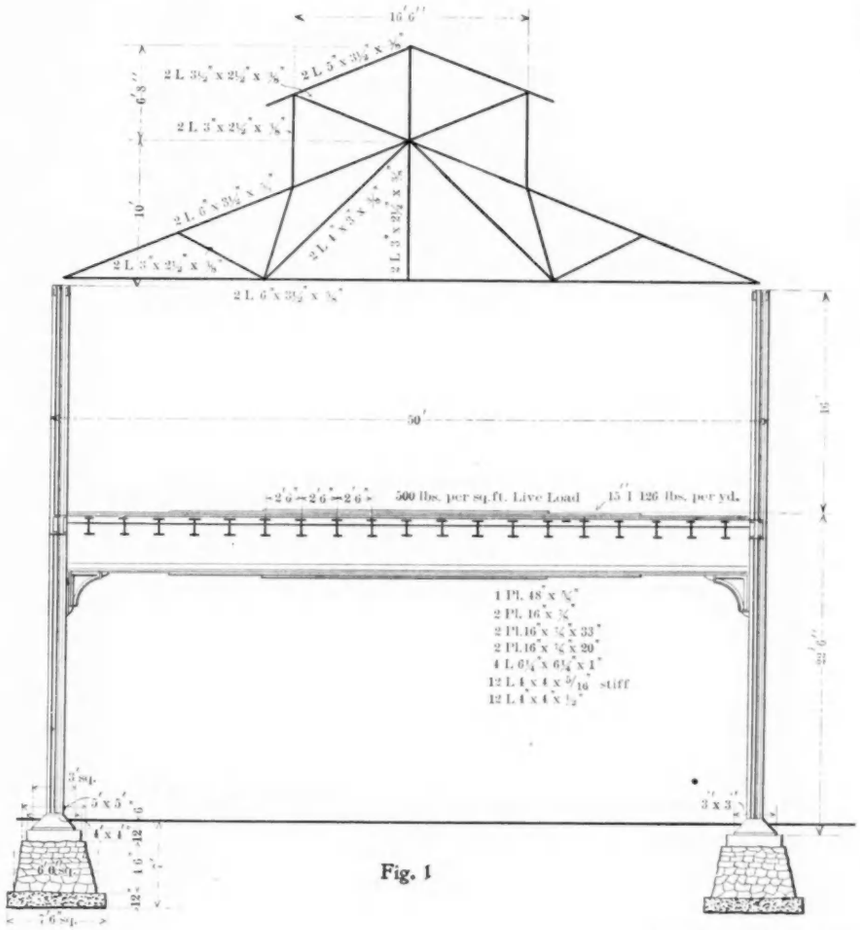
16′6″
2 L 3½″ x 2½″ x ⅜″
2 L 5″ x 3½″ x ⅜″
2 L 3″ x 2½″ x ⅜″
2 L 6″ x 3½″ x ⅜″
2 L 4″ x 3″ x ⅜″
2 L 3″ x 2½″ x ⅜″
2 L 6″ x 3½″ x ⅜″
10′
6′8″
50′
15′
2′6″ 2′6″ 2′6″ 500 lbs. per sq. ft. Live Load
15″ I 126 lbs. per yd.
1 Pl. 48″ x ⅜″
2 Pl. 16″ x ¾″
2 Pl. 16″ x ¾″ x 33″
2 Pl. 16″ x ¾″ x 20″
4 L 6¼″ x 6¼″ x 1″
12 L 4″ x 4″ x 9/16″ stiff
12 L 4″ x 4″ x ½″
22′6″
3′ Sq.
9′ x 5′
6′
4′ x 4′
4′2″
4′6″
6′ 8″ Sq.
7′6″ Sq.
3′ x 3′

Fig. 1

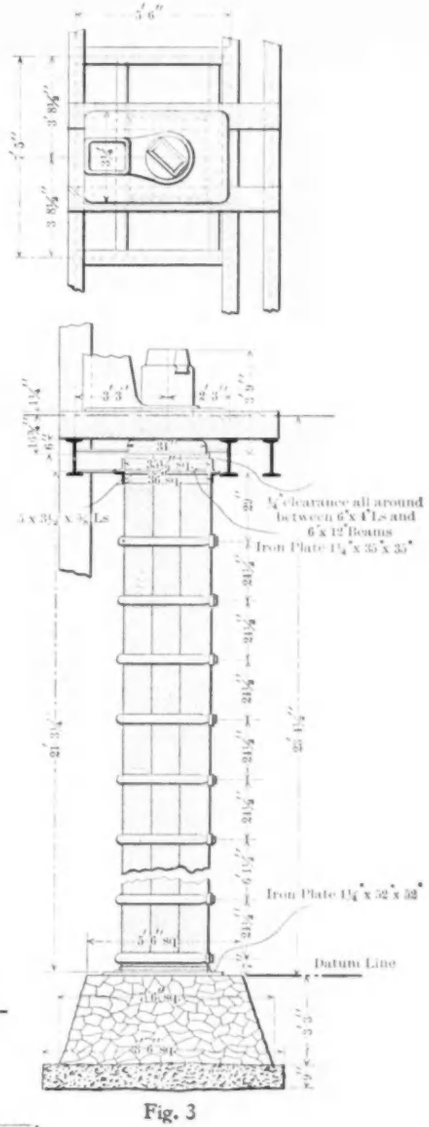

Fig. 3

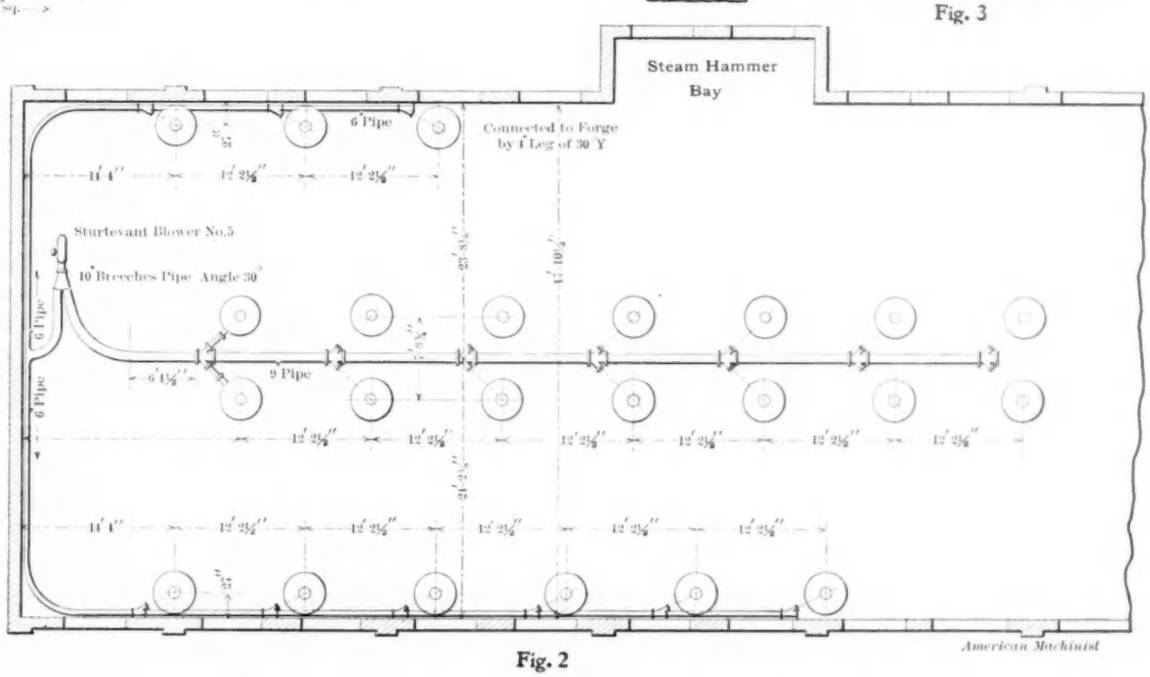

Fig. 2

A SECOND-FLOOR BLACKSMITH SHOP.

contrary is found to be positively advantageous.

We illustrate herewith in a variety of views one of these features of the Baldwin Works, which is a blacksmith shop, steam hammers and all, located on the second floor. This shop does what the Baldwin Works call their light work. It does not do the frame forging or other heavy work, although the work done is, as already intimated, sufficiently heavy to call for steam hammers. Fig. 1 gives a cross section of the building and shows the construction of the floor. This will be seen to be 50 feet in clear span without posts or other supports except the walls of the building. Heavy built up girders comprise the main floor system, while lighter I-beams connect these heavy girders. These I-beams are arched across with brick arches, on which a dirt floor 6 inches thick is placed. This floor has also a dressing of chips from the machine shop and is regularly sprinkled to keep down the dust, resulting in a hard, compact floor; in fact, when inside the shop and away from the windows one would not suspect that he were off the ground level. Fig. 2 shows a plan view of one-half the shop, giving the location of the forges and of the steam hammer bays. The entire shop contains 37 forges, served by two fans, which are driven by electric motors. A complete system of exhaust piping for carrying away the smoke is provided, which, together with the very liberal window and skylight area and elevated location, results in the cleanest and lightest shop, when the number of fires is considered, that we have ever seen. Fig. 3 shows the supports of the steam hammer anvils, which will be seen to be columns composed of nine 12-inch square timbers strongly banded together and standing on end on the concrete foundation proper. This post will be seen to pass through a guiding collar attached to the floor beams, which serves to support it sidewise, but removes all shocks from the floor proper.

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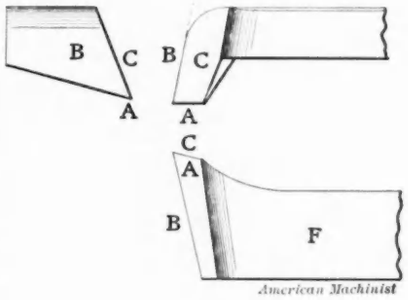
Systematic Tool-Grinding.

In a recent visit to a shop in Leipzig, Germany, I ran into a particularly disreputable-looking emery-wheel machine, with some unusual bolt-holes in the stand, and, pursuing my investigations, I also ran across some attachments which seemed to agree with the bolt-holes, but which looked very much as if someone had been trying planer tools and milling cutters on them. The funniest-looking scrap one would find in many a day. There was method in the madness which had criss-crossed these clamp-pieces; high science was back of the apparent "hit and miss" of the grooves. These clamping pieces were for use in tool grinding, and gave the proper angles, rake, slant and all that for the various tools for threading, parting, etc. Such a clamp might look like Fig. 1, or it might look very differently, according as it was intended for round, square or triangular "fits" for insertion in various holders, or for regulation long-shank solid tools, right or left-handed, for wrought or cast iron, as the case might be.

The direction and order of use of these grooves is such as to give the entire finish to the tool in three operations at most, and when possible in two; in the case of round and three-cornered bits, often in one. For instance, such a straight tool as is shown in Figs. 3 and 4 has two faces to be ground; the angle between them, viewed from above, is 60 degrees or a trifle less. The top is flat and may require no dressing at all. The under rake



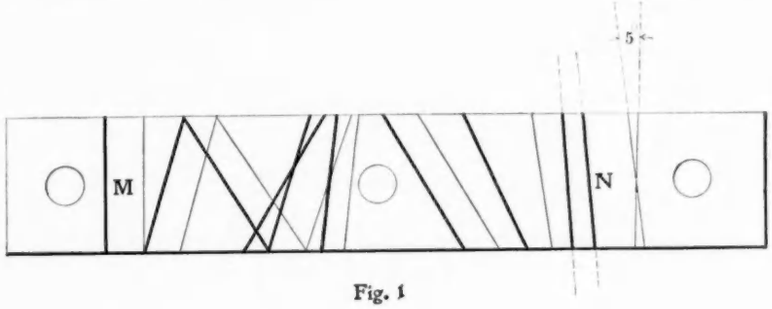


Fig. 1

Fig. 2

Fig. 3

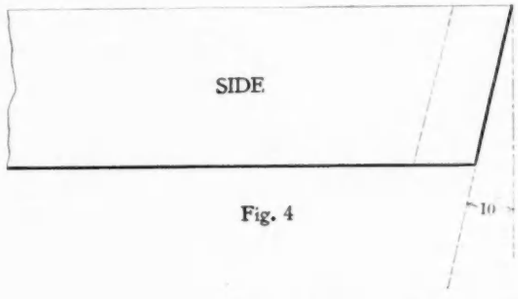


Fig. 4

RIG FOR TOOL-GRINDING.

the clamp is on the sliding rest; is clamped fast, reasonably near to the wheel; the rest is brought up to the wheel by one screw and wheel, and then given traverse by another, so that the facet *A* is ground is 10 degrees. This tool, then, is placed in a groove which, viewed from above, has an angle of 30 degrees to the edge of the clamp and consequently to the face of the emery wheel (or grindstone) when true and the wheel not unduly worn locally. A similar groove having the same angle from right to left forward gives the facet *B*. The rake is given by an upward inclination of each groove, and if

this angle be chosen rightly and worked rightly, the same rake will always be obtained, no matter who runs the machine.

The proper angle for work of each kind was determined by actual experiment before making any tool holders; but of course any shop can without the special indexing apparatus employed in Leipzig scribe off the lines on the clamping block.

Should left-hand tools be needed, such as shown in Fig. 5, in which the facet *A* is not parallel to the flank *F* of the tool shank, but has, however, its upper edge parallel with that of the tool-shank, there must be a groove which extends at right angles across the clamp, but is canted, as shown in Figs. 1 and 2 at *M*. The facet *B*, or at least the straight part of it, goes in a groove having a left-handed cut and upward inclination towards the wheel. The top facet *C* is ground on the side of the wheel, being held in a groove which makes an angle of nearly 90 degrees with the clamp top (a trifle to the left), and is canted on the bottom, as seen in *N*, Fig. 1 and 2. The rounding off of the facet can, of course, be done very readily by hand guidance, the object being merely to get the metal out of the way.

In any given groove there is but one "working edge," so that one groove may have diverging edges, thus serving as two guides. G.

▲ ▲ ▲

Metallic Joint for Steam, Air or Water.

The joints here shown, the sketches and description of which are furnished by Mr. George Mant, Starr Mansion, Camden, N. J., are modifications of a system introduced in England in 1868 for the self-sealing lids of gas retorts where the pressure does not exceed an inch of water.

Some years later Mr. Mant found it necessary to experiment with this type of self-sealing joint for high pressures in steam, air and water, and the types as now shown to our readers resulted.

Fig. 1 was 18 inches diameter; the main vessel on which the cover rested was 4 feet 6 inches diameter by 8 feet long, and was charged with steam at 90 pounds per square inch, and as the cover was required to be opened and closed once every ten minutes, day and night continuously, it was necessary to provide against any interruption of the work. The work was the manufacture of saccharum, which in the first instance was the conversion of corn permeated with diluted sulphuric acid. As soon as the corn, about 1,000 pounds, had been placed in the vessel and the cover screwed down, 1,000 pounds of water from the boiler was introduced, and then steam at 90 pounds pressure was turned on, and the conversion was completed in about three minutes. The matter was then blown out into a neutralizing vat, when the cover was again opened and the same operation continued. The seat of the cover was a pewter ring, which, on showing signs of wear, was simply smoothed over again by the soldering iron, so that for the renewal of this joint new material is unnecessary. The use of the soldering iron was found to be required every three months; but the smoothing of the pewter ring was effected in less than ten minutes.

This form of joint can be used in many ways. Fig. 2 shows another modification of the same. A series of rings forming a filter from 12 to 48 inches diameter, according to capacity desired, were strung on two bars, one of which is shown passing through rings, the filtering medium being inside the rings, which were closed upon each other by means of a powerful screw passing through the head of the

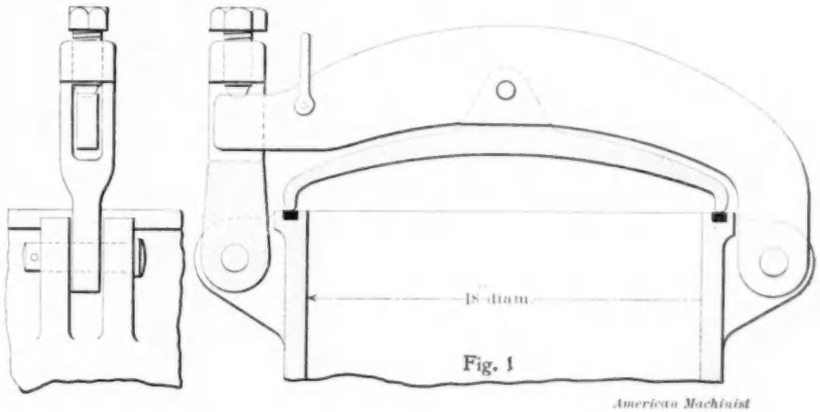


Fig. 1

American Machinist

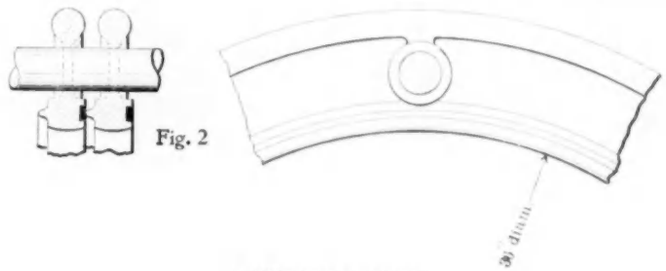


Fig. 2

A METALLIC JOINT.

filter press. As many as fifty of these rings, 4 feet in diameter, are sometimes used, and all of the joints are simultaneously closed. The filters were worked under air and water pressures up to 1,000 pounds per square inch. These joints, until very much worn, never leaked in the least, and were always repaired in the way before referred to.

If desirable, the pewter seat can be placed on the cover, the same being fitted over dowel pins to keep in a true position.

It will be seen that the joint is suitable for all kinds of steam covers and doors of pumps, and especially throughout sugar plants, where large doors are frequently in use, and have to be opened and closed very frequently. The saving of heavy rubber joints will be found most economical.

The Placeof Our Destination—XIV.

Editor American Machinist:

At the Stockholm exhibition there are far too many things of great interest to attempt to notice all, but although the Sloyd system of technical school training is not exactly machine tools, it is mechanical, and worthy of a more extended consideration than I can give it. It differs from the Russian system (which is the common system with us) in this: While the Russian is a series of lessons, training students to do certain things irrespective of their connection with what use is to be made of them, the Swedish system is entirely in the direction of making complete things for use or ornament, and at the exhibition there is shown a variety of useful products in all sorts of material—women's work, art work and wood work, ranging from boot-jacks to violins.

The advocates of the Russian system believe that if a boy learns to dovetail pieces together, he can then dovetail a box or a bureau drawer or anything else, while the believers in the Swedish system think that a boy can learn to dovetail pieces together just as well in making a box as in fitting pieces together that are of no use, and besides, that the boy will take more interest in his work. The advocates of the Russian system refer to the practice of the accomplished musicians who practice term after term on scales and movements, forgetting that 25 per cent. of those who practice term upon term at their exercises never make musicians at all, and a large percentage of the rest only indifferent ones. It is undisputably true that the great musicians are made on the Russian system, and equally true that it is the fiddler or the down South

colored banjo player who make people feel as if they wanted to dance. I do not know that the comparison is an apt one, but I am very sure that I believe the Swedish system by far the best. I have always been astonished at the apparent success the teachers, in blacksmithing, for instance, have in getting their students to do such work as they do do, with so little experience, and this by the Russian system, and equally astonished to find that, in practice, they are able to make so little use of it. The system holds out false hopes.

I believe the entire school system in Sweden runs in the direction of teaching industrial pursuits. This may be because they are an industrious people, or it may be that the industrial training makes them an industrial people. While they do not do things in an awful hurry, idleness and intemperance are not apparent.

Of the many things that will remain permanently in my memory of the Stockholm exhibition, two things will stand out above all others. One a large picture of thirty-eight men standing in an elegant room with an inlaid oak floor. Every figure in the entire group stands out like a living man, all dressed in military or court attire, and no matter what kind of cloth or color either is dressed in, it is not a painting but the real thing one sees. It is realistic to the end. Another thing is the steel goods, such as knives, shears, paper-cutters and a variety of things inlaid with enamel and gold. I know from the prices that it must be done cheaply, but there is no cheap look about it.

I have just received a letter from a friend for whom I have the greatest respect, and who gives his advice out of the kindest of motives, who says my letters will more likely be believed if I tell both sides of the story—the things we do better than they are done abroad, as well as those done better than we do, and he suggests that when I get in Austria I describe some of the awful sights of women carrying bricks and mortar for the builders. I need not wait until I get to Austria, for we have just seen a woman carrying mortar to masons and a woman riding a bicycle with bloomers, and just been for the steamer tickets and found the entire office corps ladies. I myself do not believe it will do any good to tell both sides, because the man who tells both sides impartially must be talking to an impartial audience to have the result have its true weight, and though I may be mistaken, and though it may be a very discourteous thing to say, I do not believe your readers less prejudiced than myself. Take the story as I have told it, and let it be three times repeated. The first time the last two-thirds will be left off; the next time all the mason tenders in Sweden will be women, and the next time carrying mortar in a hod up a ladder. Now, I did not say the woman was carrying mortar in a hod up a ladder, and I believe it simply a rare instance that I saw her carrying mortar at all.

It seems to me that the fact must be perfectly plain to your readers, that I have not tried and that I do not intend to tell both sides of the story, or all I see of interest and to find fault with; and I do not do it, first, because it would take the entire pages of the "American Machinist" to tell it (while I am trying to confine myself to a single page), and second, I do not believe this eternal cracking up of our mechanical achievements and our own country a good thing to do. Besides, Mr. Editor, you have both the governor and throttle in your own hands. You can, as requested, leave out what you deem inadvisable to publish, or even close the throttle, without giving me the least offense.

As this has diverted me from the thread of my story, I will take occasion to illustrate my aim by giving a little experience. The Direct Separator Company sent over a separator to England with, as usual, a glass gage and lubricator with it. The mechanic who went to mount the separator on the engine said at once: "These fittings have never been on," and I said I thought they had. And they had been, according to the American idea, but a botch job, according to the English idea, and he proceeded to do the job over, tapping out the holes and threading up the stems until the hexagon shoulder set square down against the jacket. That is the English idea of a good job, and of course the correct one, but we had always been accustomed to see them the other way and did not think but that it was all right.

Another case: An American in London, who is agent for a Boston concern, tells of one out of many cases in his experience. He was to put a blower in a new engine room and wanted his people to dress off and polish the edges where the two halves of the casing come together, which he knew and which the makers ought to have known, was, when left mismatched, a botched job, but he says he had the hardest kind of a time to get the makers to do it. Of course, these are trivial things to notice, but they count in building up a reputation.

Before leaving Stockholm, which proves to be the place of our destination, I will notice two things special to this country, or at least very conspicuous ones—the stoves, which are beautiful pieces of porcelain, as large as bookcases, 2½ to 3 feet wide, a foot and a half deep and 7 or 8 feet high, built like a bookcase in shape, set back against the wall, and at times in an architectural style conforming to the style of the room. There is no visible stovepipe and the firebox and brass door are very small. In practice they only build one fire a day, and the surplus heat is absorbed by the brick work rather than half of it going up the chimney. The natives say that they keep them plenty warm enough all day long. Americans say they do not. Now, I believe both to be right. We are so in the habit of keeping our houses hot in Winter that our Winters are more disagreeable to foreigners because of the exceptional heat of our rooms than on account of the cold outdoors. This I can easily understand, because we found them enjoying the cool weather when I was uncomfortably cold with full Winter clothing.

We leave the fine buildings, clean streets and pleasant waters of Stockholm reluctantly, turning south by a different route from which we came—the Gota Ship Canal. Years ago Denmark claimed control over the Baltic Sea and collected toll from all vessels sailing past her coast. This was a tax on the East coast of Sweden, and she determined to circumvent Denmark rather than fight her, and so built the canal from Stockholm on the middle east to Goteberg, on the North Sea, almost 400 miles to the southwest. Out of the 460 miles about 30 is in the Baltic between the islands and the mainland, 30 miles true canal and the balance through lakes, rivers, inlets and bays.

The engineer was Nils Ericsson, an elder brother of Capt. John Ericsson, who himself served in the Engineer Corps while somewhere between 11 and 15 years of age. Our route followed the following direction: Going west some 20 or 30 miles in the lake, turning south in a bay extending many miles reaches so near an inlet running up from the Baltic that a short piece of canal, and a lock or two connect the two.

If one examines a common map he will see a number of islands laid down along the east coast, but on a marine map, where every island and rock is laid down, it looks as if the islands were put on with a pepper box, and in between these islands and the mainland we sailed, turning again to the west many miles up another inlet, or outlet, to a river, brings us to a chain of locks and to the backbone of Sweden, where we find at Motala a very large industry, where they build engines and equip steamships such as navigate the canal, locomotives, iron bridges, roofs and other things, the power being derived from the river which is the outlet to Lake Wettern. Crossing this lake and up a branch, a short piece of canal into an outreaching branch into Lake Wenern and turning to the southwest for a hundred miles or so, we come to the outlet of this lake, down which the water tumbles through a gorge it has plowed through the granite rock, going down two or three hundred feet in as many miles, forming one of the sights of Sweden. While we are walking down the gorge the boat is locked down some thirty-four or thirty-five locks to Trollhattan. A nice river ride brings us to Goteborg (or Gothenburg), a city second in size, I believe, to Stockholm and a close second in cleanliness and beauty of some of its buildings.

Six or eight hours' ride to Helsingberg, crossing the narrow channel between Sweden and Denmark to Elsinore, and a couple of hours more brought us to Copenhagen, where we had passed through three weeks before. The four days from Stockholm to Copenhagen were agreeable ones.

JOHN E. SWEET.

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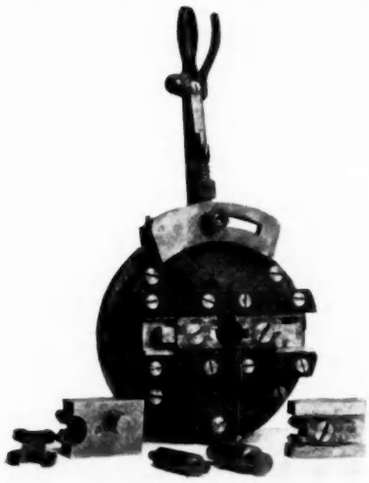
New Pipe-Cutting Machines.

The firm of D. Saunders' Sons, of Yonkers, N. Y., have recently developed a new line of pipe-cutting machines, types of which are here illustrated. The special features of the machines are the quick-acting lever grip chuck, by which the pipe is seized and firmly held without stopping the machine, and the expanding die head by which when the thread is cut the chasers are withdrawn and the pipe is released, so that the operations of cutting off the pipe and of cutting threads may go on continuously without stopping the machine.

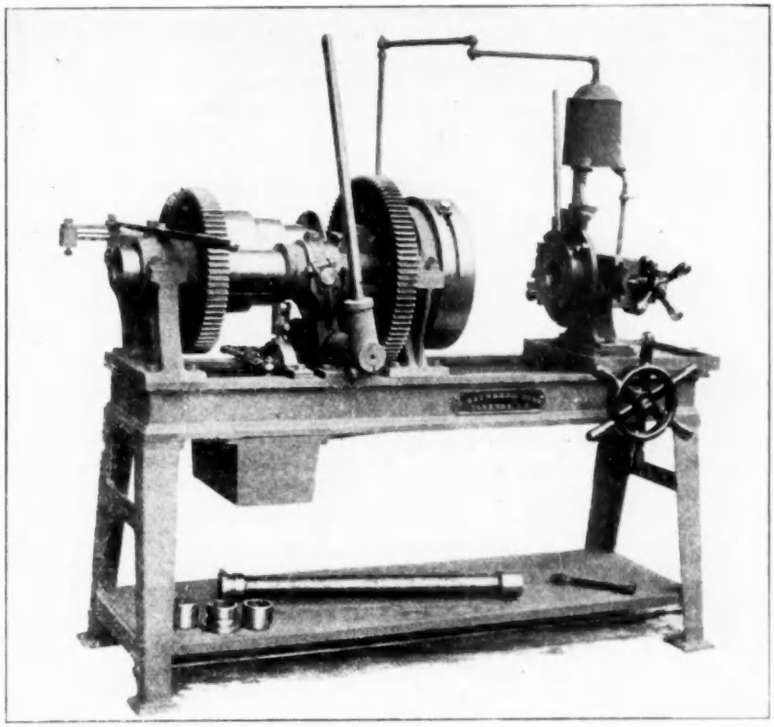
Fig. 1 shows the machine designated

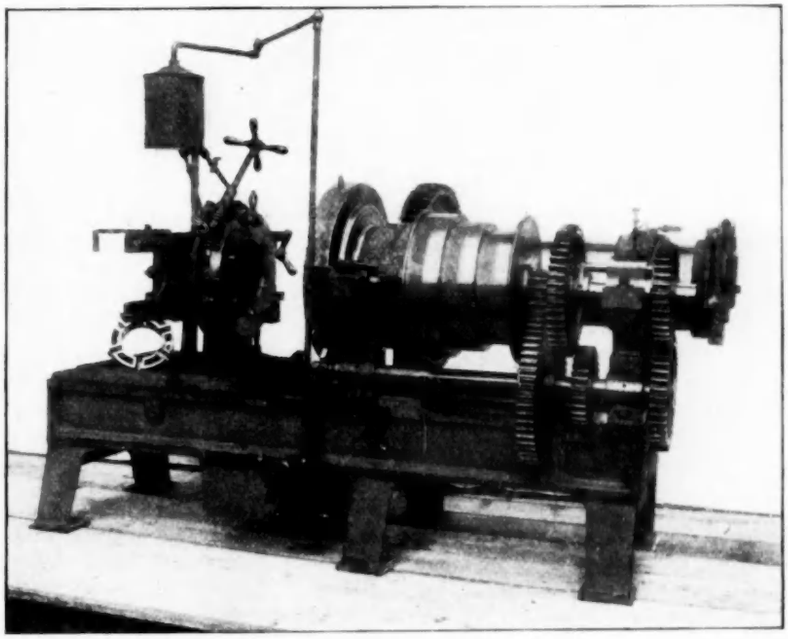


CHANGEABLE DIES.

as No. 2 A, which is for the smaller sizes of pipe, cutting from ¼ inch to 2 inches inclusive. The driving cone is secured by a central hub to the middle of the shaft at the back. On the same shaft are two splined sliding pinions, one at each end of the cone, and connected by two rods through the cone so that they slide backward together. They are moved by the horizontal lever pivoted on the cap of the back bearing. When the pinions are slid forward the small front pinion engages the larger gear on the main spindle, and the slower speed results. The back pinion then lies inside the cone. When the pinions are slid back the front pinion lies inside that end of the cone, the back pinion engages the smaller gear on the spindle and the faster speed is secured. The cone has four steps, so that there are eight speeds to the machine. The pipe to be cut is passed through the hollow spindle, the grip chuck being set approximately for the size by the screw in the peripheral slot on the chuck. When the long vertical lever is thrown forward the jaws are set and locked by a series of sliding wedges, each operating one of the four jaws. When the lever is thrown back the jaws are withdrawn sufficiently to allow the pipe to be thrust forward or to be withdrawn as may be necessary. The jaws have teeth of M shape, and can readily be sharpened by grinding without drawing the temper. Thimbles fitting the different sizes are held by a screw in the back end of the spindle, and for sizes below ¾ inch the long sleeve shown under the machine is inserted and held by the same means.

The carriage is moved along by the large hand wheel. The thread-cutting die works close up to the gripping chuck, so that short pieces of pipe may be threaded without the use of a nipple chuck. The die head slides horizontally and is moved to the rear out of the way when cutting off. It is easily slid forward against a stop pin, which at once brings it central





SAUNDERS' PIPE-THREADING MACHINES.

again. The vertical lever opens and closes the dies, and an adjustable stop determines the size. For this small machine it is found best to have a complete die head for each size, as the changes are so frequent. The rest has V-jaws adjusted by a hand wheel at the rear for steadying the pipe when cutting off. The cutting off tools, front and rear, are both operated by the small hand wheel in front of the rest. Round bar iron is cut off very quickly by these tools. An oil pump is a part of the machine and continually floods the dies. Large tank capacity is provided.

Fig. 2 shows an improved die head adaptable to any machine. For changing sizes the slides and chasers are slipped out and others inserted. They are adjusted to size by closing the teeth upon the round sizing gage and then tightening the stop pin. The chasers may be sharpened by grinding.

Fig. 3 is a rear view of the large machine, which cuts pipes from 2½ inches to 8 inches. The cone runs loose on its shaft, and the pinion at the back of it is fast to it. The front pinion is fast to the shaft and is always in mesh with the large gear on the main spindle. The gear changes are made by sliding the two gears on the cone shaft, which is done by the horizontal lever projecting to the front of the machine. The die head has six chasers, which are quickly and easily changed for the different sizes. The ring with the six grooves is used to steady the chasers for the smaller sizes. The die is opened and closed by the worm on the oblique shaft. This head also is pushed to the rear when cutting off. A two-jawed adjustable chuck is provided at the back end of the live spindle to center and steady the pipes. Either a universal or an independent jaw gripping chuck is furnished with the machine.

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A New Formula for Determining the Width of Leather Belting.*

BY PROF. JOHN J. FLATHER, PURDUE UNIVERSITY, LAFAYETTE, IND.

In this paper the author gave a review of an article he had written for the "Western Electrician," in which a rational formula is presented for determining the width of belting, viz.:

$$b = C\,C'\,C''\,k_0\,\frac{H.\,P.}{V}$$

Professor Flather stated that, in general, there were five principal considerations which should obtain in determining the size of belt, viz., coefficient of friction, arc of contact, speed of belt, strength of belt per square inch of section and durability.

Experimental work has usually been directed to determine the coefficient of friction, and it has been shown by exhaustive tests that the coefficient of friction, Φ, of leather belting on smooth cast-iron pulleys may vary from 12 per cent. to 165 per cent., depending upon so many factors that it is impossible to so corelate them as to determine accurately what the coefficient may be in any given case.

In general, we may say that the value of the coefficient depends upon the nature and condition of the leather, the percentage of slip, temperature and humidity, and probably pressure.*

The velocity of sliding, which influences the friction more than any other factor, is directly proportional to the belt speed, and may safely be estimated at 1 per cent. of the speed per pulley—that is, 2 per cent. for each pair of pulleys. The maximum slip permissible with horizontal belts is about 20 per cent.; a greater slip than this is liable to throw the belt off.

For the past twenty-five years the coefficient of Towne & Briggs,† viz., 42 per cent., has generally been accepted by engineers; but this was reduced from the results of experiments having a large slip (200 feet per minute), which gave the coefficient equal to 0.58, so that the value recommended is only 0.70 of that obtained by experiment. Even with this allowance it is probable that the value is somewhat higher than average practice would warrant. With percentages of slip varying from 0.8 to 2 per cent., Mr. Lewis finds the coefficient to vary from 0.25 to 1.38, the first value being obtained for a percentage of slip equal to 1.5, and the second for a slip of 1.7 per cent. Two per cent. slip gave $\Phi = 0.45$. Other experimenters find that Φ varies from 0.12 to 0.58, depending principally upon the rate of slip.‡

Professor Lanza's numerous tests made at the Massachusetts Institute of Technology indicate that 27 per cent. is the most suitable value to use for a low rate of slip. His results§ were obtained on belts running about 1,500 feet per minute and with a slip of about 3 feet per minute.

Regarding the strength of belting, as might be expected this is extremely variable. Kirkaldy's tests, which cover a wide range, show the strength to vary from 2,000 to 6,000 pounds per square inch of section.‖

The various tests indicate that double belts are superior to single, both in respect to their greater uniformity and also a lesser liability to become crooked by reason of uneven stretching, due, probably, to the fact that the former are composed of two layers, which tend to neutralize any local imperfections occurring in either. It is evident that the strength of a belt cannot be stronger than that of the joint. With cemented joints, the splice, if properly made, is not materially weaker than the body of the belt; with riveted joints the ultimate strength, as given by Towne,* is 1,750 pounds per square inch, and for laced belts 960 pounds.

In existing belt transmissions the stress per square inch of section is extremely variable, ranging from 30 to 1,200 pounds per square inch. The reasons for this are two-fold: First, a superior quality of leather will permit a greater stress without undue trouble and expense in repairs; and secondly, some belts are calculated to transmit a stress greatly in excess of that to which they are actually subjected.

A feature often neglected in the ordinary formulæ is that of durability of the belts. F. W. Taylor, in his excellent paper: "Notes on Belting," states† that "the one consideration which should have more weight than all others in making up tables and rules for the use and care of belting is how to secure the least possible interruption to manufacture from this source."

In calculating the total expense of belting and the manufacturing cost chargeable to this account, it has been observed that by far the largest item is the time lost on the machines while the belts are being relaced and repaired; especially is this true in those establishments where the running of a series of machines is dependent one upon another, and the stoppage of one machine involves delays on others.

A glance at some of the existing belt formulæ shows that the older millwrights frequently allowed 550 feet per minute for a single belt. The probable reason for the satisfactory running of these belts has already been pointed out, viz., overrating the capacity of the machine and estimating upon a horse power three or four times greater than actually required.

Some of the more recent rules used by shopmen assume that a single belt one inch wide will transmit one horse power for every 800 to 1,000 feet per minute; other rules call for a double belt of the same width.

The first cost of equipping a plant under the latter rules would often prohibit the use of such heavy belts; moreover, in many situations it is probable that equally satisfactory results are obtained under stresses, apparently twice as great, especially in those cases where the belt runs at moderate speed over a pair of approximately equal pulleys of large diameter, and is not shifted from one pulley to another. On the other hand, the conditions might be such as to call for certain belts fully as wide if not wider than those calculated from these rules.

Such a case might arise when running

* Presented before Sect. D, Am. Assoc. for the Advancement of Science, Detroit.

* See paper by Wilfred Lewis. Trans. A.S.M.E., vol. vii., p. 549.

† See Journal of the Franklin Institute, February, 1867.

‡ Trans. A. S. M. E., Vol. vii., p. 347.

§ *Ibid*

‖ See Kent's Tables; also, "American Machinist," Nov. 14, 1895.

* See Journal, Franklin Institute, 1867.

† Trans. A. S. M. E., Vol. xv., p. 212, *et seq.*

at a high belt speed from a large to a very small pulley (or vice versa) with the tight side of the belt on top; in this case the centrifugal force would diminish the effective tension, the arc of contact would be lessened, and the adhesion of the thick belt on the small pulley would not be as effective owing to imperfect contact, due both to air entrainment and to a wrinkled belt produced by bending; all of these would necessitate an increased width of belt.

Owing to these various causes it is impracticable to determine a general formula which will be applicable in all cases. We may, however, suggest limitations. As someone has aptly remarked, a significant factor (which, however, cannot enter algebraically into the equation), is the judgment of the designer.

Usually the conditions are such that the principal modifying agencies are known, and if these be taken into account by choosing suitable constants (to be selected for any particular case when the dada are known), a proper belt width may be obtained, which it is believed will be entirely satisfactory, considering durability and expense of operation under those conditions which are liable to arise in ordinary practice. In the formula deduced by Professor Flather, the following factors are allowed to influence the width of belt, viz.:

Kind of joint—i. e., laced or spliced.

Thickness of belt—single, double or triple.

Diameter of smallest pulley.

Least arc of contact.

Centrifugal force due to weight and velocity of belt.

In determining the formula, the allowable working stress was taken at 350 pounds per square inch section for cemented joints, and three-fourths of this, or 265 pounds per square inch, for laced joints.

The weight of belt for calculating the centrifugal force was ascertained from a large number of examples, and was found to be 0.41 pounds per square inch of section 1 foot long.

The coefficient of friction used was 0.27. The thickness of single belting was assumed to be 0.20 inch; double and triple thickness, 0.40 and 0.60 inch, respectively.

The formula deduced is:

$$b = C\,C'\,C''\,k_0 \times \frac{H.\,P.}{V}$$

in which

b = breadth of belt in inches;
C = coefficient depending upon thickness of belt and kind of joint;
C' = multiplier when double or triple belts are used with small pulleys;
C'' = multiplier depending upon arc of contact;
k_0 = multiplier when centrifugal force is considered;
$H.P.$ = Horse-power transmitted;
V = Velocity of belt in feet, per minute.

C has been determined rationally from preceding data, and is found to equal 800 for cement joint, and 1,050 for laced joint, for single thickness of belt.

By neglecting influence of pulley diameter, centrifugal force and arc of contact, the width of single belt would be:

$$b = 800\,\frac{H.\,P.}{V} \text{ for cement joint, and}$$

$$1050\,\frac{H.\,P.}{V} \text{ " laced "}$$

The pulley diameter, when small, is allowed to influence the width of belt, as shown in Table II.

The arc of contact may cause the belt width to be decreased 25 per cent. for an arc of 240 degrees, or to be increased 33 per cent. for an arc of 120 degrees, as shown in Table III.

The speed of belt up to about 2,000 feet per minute does not appreciably affect the width of belt; but for higher speeds the coefficient varies from 1.10 for a speed of 2,500 feet per minute to 1.65 for a speed of 5,500 feet per minute.

The following tables containing the above multipliers accompany the paper:

TABLE I.

Values of $C = \frac{Vb}{H.\,P.}$

	Cement joint.	Laced joint.
Single belt.....	800	1050
Double belt.....	$\frac{800}{2}$	$\frac{1050}{2}$
Triple belt.....	$\frac{800}{3}$	$\frac{1050}{3}$

TABLE II.

Values of C' = multiplier when Double or Triple Belts are used with small pulleys.

For double belts when dia. of pulleys =	Or Triple belts when dia. of pulleys =	Value of co-efficient, C'
8 inches	18 inches	1÷0.7 = 1.40
12 "	26 "	1÷0.8 = 1.25
20 "	42 "	1÷0.9 = 1.10

TABLE III.

Values of C'' for different Arcs of Contact.

Value of angle.		Value of co-efficient C''.
In degrees.	In circ. measure.	
120°	2.09	1.33
130	2.26	1.27
140	2.45	1.21
150	2.62	1.15
160	2.79	1.10
170	2.96	1.05
180	**3.14**	**1.00**
190	3.32	.95
200	3.49	.91
210	3.66	.87
220	3.84	.83
230	4.02	.79
240	4.18	.75

TABLE IV.

Values of co-efficient k_0 = multiplier when centrifugal force is considered.

Velocity in feet per minute.	Cemented Belt.	Laced Belt.
2,500	1.06	1.10
3,000	1.10	1.14
3,500	1.14	1.20
4,000	1.19	1.27
4,500	1.26	1.37
5,000	1.34	1.50
5,500	1.44	1.65
6,000	1.58	1.87

$$b = C\,C'\,C''\,k_0 \times \frac{H.\,P.}{V}$$

From the formula and the preceding tables a satisfactory width of belt can be obtained for any given case if the data are known.

For example, let it be required to find width of double belt to transmit 175 horse-power at 3,180 feet per minute; pulleys 90 and 60 inches diameter. As cemented joints should always be used with double belts, we shall have:

$$C = \frac{800}{2} \qquad \text{(Table I.)}$$

With the diameters of pulleys used, it is probable that $C'' = 1.05$ (Table III), and $k_0 = 1.11$ (Table IV), hence

$$b = C\,C''\,k_0\,\frac{H.\,P.}{V} = \frac{800}{2} \times 1.05 \times 1.11 \times \frac{175}{3,180} = 24''$$

A belt 19½ inches in width was used.

An electric motor running at 1,600 revolutions per minute transmits an average load of 12 horse-power through a single belt cement spliced; motor pulley, 7½ inches diameter; driven pulley, 48 inches diameter. Under these conditions the arc of contact is about 140 degrees, and $V = 2,950$; hence

$$b = 800 \times 1.4 \times 1.2 \times 1.10 \times \frac{12}{2,950} = 6''$$

A single belt (with cemented splice) 6 inches wide is in use. This belt occasionally transmits 15 horse-power for several hours at a time.

The horse-power which can be transmitted by a belt of given width may be obtained in the same way by transposition of formula; that is,

$$H.\,P. = \frac{Vb}{C\,C'\,C''\,k_0}$$

For example, suppose it be required to determine how much average horse-power a 20-inch double belt (cement joint) will transmit when running at a velocity of 3,800 feet per minute, considering durability of belt; the smaller pulley is 16 inches diameter, and the arc of contact about 155 degrees. Here $C = 800 \div 2$; $C' = 1.1$; $C'' = 1.12$, and $k_0 = 1.17$; hence

$$\frac{3800 \times 20}{400 \times 1.1 \times 1.12 \times 1.17} = 135\ H.\,P.$$

[We recently had occasion to determine the belt practice of several builders

of Corliss engines, and the figures obtained are of interest in this connection. The builders referred to are in the front rank, and are designated by different letters in the first column of the following table. The second column gives the rated horse-power of the engines, and the third the value of *C*. At the speed of this type of engine the centrifugal force may be fairly ignored, as well as the effect due to wrapping heavy belts on small pulleys. The effect due to the arc of contact should by right be included, but as it is impossible to do it, that, likewise, is ignored. If this could be included, the effect would be to reduce the value of *C*.

Builder.	Rated H.P. of Engine.	Value of *C*.
A.....	50	520
B.....	50	750
C.....	80	540
A.....	100	500
B.....	130	525
C.....	150	400
A.....	200	486
C.....	265	403
B.....	300	425
A.....	325	375
C.....	350	414
B.....	380	416

As an engine fly-wheel would naturally be made large enough to carry the full power of the engine, while these calculations were made for the rated power, it follows that a smaller value of *C* than those named would safely carry the power.—Ed.]

▲ ▲ ▲

An Automatic Feed Stop for Lathes.

The accompanying cuts show a recently patented automatic feed stop for engine lathes. By its use the feed may be reliably disengaged at any predetermined point. *B* is the usual splined feed rod. *H* is a shoe or supporting box attached to the inside of the apron; the hubs *h* and *h'*, serving as guides or bearings, are integral parts of *H*. The long sleeve *E* is screwed fast into the shorter sleeve *F*, and the latter having a feather fitting into the spline in *B*, these two revolve constantly with *B*, but have also a limited longitudinal movement when required. The hollow sleeve *I* has the worm *I'* on the right-hand end of it. This worm is always in mesh with the large worm wheel of the gear train, the feed being thrown on or off by a friction wheel tightened by the little cross handle in the front of the apron in the usual way. The collar *J* is pinned into the other end of *I*. On the inner face of the collar *J*, where it projects into the sleeve *I*, are clutch teeth corresponding to those in the face of *F*. The thrust of the large coil spring tends to push *E* and *F* to the left and keep the clutch engaged and the worm constantly revolving. When the feed is on and the rest is moving to the left, the collar *M* being set at the required point, the left-hand end of *E* comes in contact with this collar, and the clutch is by this means disengaged and the revolution of the worm is stopped. The collar *M*, when set, may thus be depended on to stop the advance of the cutting tool at precisely the same point, and it may be set very accurately, allowance always being made for the depth of engagement of the clutch.

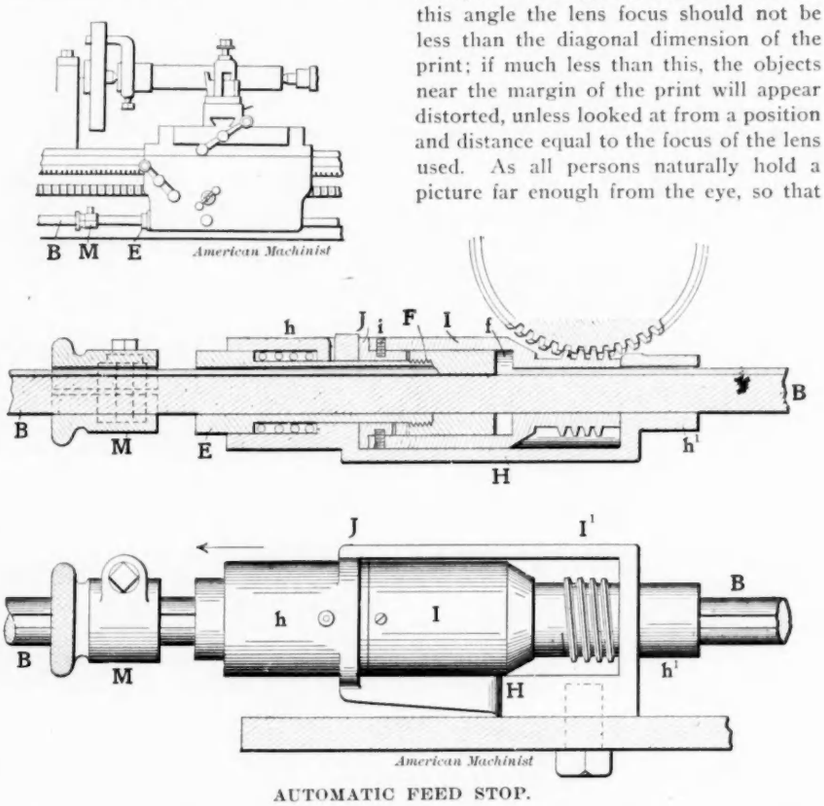
▲ ▲ ▲

Letters from Practical Men.

Machine and Shop Photography.

Editor American Machinist:

In August 12th issue of the "American Machinist" is an interesting and instructive article on machine photography, and what is said of the importance of fully understanding the working properties of lenses, and the purpose and effect of each



AUTOMATIC FEED STOP.

chemical used on the plate, should be strongly impressed on every person undertaking to photograph machinery or other things. Speaking of developing agents, the writer says that sulphite of soda is generally used as a color giver. This is true only in a negative sense, as what it does is to prevent the developer from staining the negative film a yellow color, and causing it to print slow.

Sulphite is also a good preservative of some developers when in solution, but the black color of the negative is due to the pyrogallic acid, or other similar chemical, in the developer, and very good negatives may be made without the sulphite, though greater care in developing is required.

The worst stumbling-block in the way of a beginner is the difficulty of giving a proper exposure, and knowing it to be so; for until one has acquired the art of developing, he may not know whether failure is due to the developing or to the exposure.

To beginners I would strongly advise the use of an exposure meter, as it is not expensive, and will soon save its cost by preventing loss of plates, besides the great satisfaction of doing better work from the start.

The focus of the lens should be selected in proportion to the size of plate used, or more properly the size of print desired, for a 5-inch focus on a 4 x 5-inch print would give the same angle of view as an 8-inch focus on a 5 x 8 print. The extreme angle of vision without moving the eye is about 55 degrees, and to attain this angle the lens focus should not be less than the diagonal dimension of the print; if much less than this, the objects near the margin of the print will appear distorted, unless looked at from a position and distance equal to the focus of the lens used. As all persons naturally hold a picture far enough from the eye, so that it will all be within the natural angle of vision, it follows that it is impossible to make a generally pleasing photograph with a relatively short focus lens. A rapid rectilinear lens is the most suitable, and fast plates are also desirable, for both reduce the time required to do the work, and therefore reduce the cost.

The excellent shop photograph you show in the August 26th issue is almost, if not quite, equaled by another in September 2d issue, entitled "Mixing Room," and both are remarkable by the almost total absence of halation at the windows, the means of preventing which would be very interesting to me, as it doubtless would be to others. Also if I could learn the focal value of the stop, and the time of exposure for taking the Dean Bros. shop,

and the same together with the speed of plate used for taking the "Mixing Room," I would fully appreciate the information.

I just happened to note that Mr. Landsing does not mention bromide of potash, one of the chemicals often used in developers as a restrainer when overexposure has taken place; but it has, in addition, the valuable property, not so generally known, of preventing chemical fog on the plate, thus allowing development to be carried farther without obscuring the image on the plate.

A. RANDOLPH.

Salem, O.

[The absence of halation in the illustrations of September 2d issue was due to the art of the retoucher, and not to that of the photographer. The illustration of the August 26th issue was made without retouching.—Ed.]

▲ ▲ ▲

Making Hollow Steel Balls.

Editor American Machinist:

In answer to your correspondent who wishes to make steel spheres 4 inches diameter, there are two ways in which this can be done. If wanted in small lots, they can be spun on an ordinary lathe, making them in halves, which may be seamed or soldered together, forming a complete globe.

The second and best way, if the spheres are wanted in quantities, is to draw them out in a press. They can be made in halves as before, or by cutting a blank of the proper shape, they can be formed up and then closed down, forming a complete ball from one piece of stock.

J. L. LUCAS.

Providence, R. I.

▲ ▲ ▲

Micrometer Cuts for Taps and Milling Cutters.

Editor American Machinist:

I have to confess that I have been learning something lately through the columns of the "American Machinist," about taps and how they ought to be made. When a fellow gets up and confesses that he knows more than he did, it may be a disguised form of brag; but it's after the manner of men. I have known for a long time how taps ought not to be made, but all the while I have been thinking it was the right way, and I have certainly made hundreds of taps, for nuts and other machine work, with the thread first cut parallel and then the tops of the teeth tapered off with a long taper clear down to the bottom of the thread. That is the kind of tap that everybody used for years, and that almost everybody is using today. Of course, it is all wrong. Everybody knows how hard it is to hold a very thin cut on a piece in the lathe or on the planer, especially if it is rather hard, and more especially if you are working it dry and then come to a greasy spot, or even a spot where somebody's hand has touched it, and particularly if the edge of the tool is worn a little. But nobody, apparently, has ever thought of this in connection with a tap, and we have all gone on making them with this precise cutting condition as a part of their existence.

If the thread on a tap is first cut parallel, and if then the tops of the threads are turned off taper, all of the cutting, when tapping a nut, is done by the flat tops of the threads. Who has ever figured out the thickness of the cut? I confess that I never did, and I never knew of its being done by anybody else until last week, in the "American Machinist," in the letter by Mr. J. C. Green. Say that we have a ¾-inch tap with the taper part 4 inches long, and four flutes to the tap. There will then be 160 cutting teeth, each of which will pass through each thread of the nut and be supposed to do its share of the cutting. If the thread is standard, or 10 to the inch, the length of the slanting side of each thread will be .1 inch, and the perpendicular depth of the thread will be .0866 inch, and $.0866 \div 160 = .00054$ inch. One-half of one-thousandth of an inch is a rather thin chip, yet that is all that we have been allowing our taps to cut, and we have been expecting them to do as good service under conditions which would be practically impossible with a common lathe or planer tool, unless it had an edge as keen as a razor. We all know how, even if we do get such a keen edge on a tool, it is necessary to be continually grinding or oil-stoning it, if we are taking very thin cuts. The tap, however, has never been the subject of any such kindness. It has had to rub out the metal as best it could, getting hot and wearing so fast that, with eight or ten times the length of cutting service allowed for the bolt-cutting die of the same size, it would usually not last half as long. There is in any shop more frequent renewal of taps than of dies, although the average length of threads cut on bolts is double the thickness of the nuts.

The trouble is that we have never brought our practical experience with cutting tools to bear upon tap conditions. It is quite impossible to explain why we have not, or how we could possibly have avoided it as we generally have. Last year Mr. Arnold told us about "limit" taps, which did all of their cutting with two or three threads of their length, but he was so taken up with maintaining the "limit" idea, as to diameter, that he failed to fully convey the idea—to me, certainly—of how the shortness of the cutting part and the fewness of cutting teeth really gave them a fair cutting chance. I followed Mr. Arnold's article with a few remarks about the "limit" idea, but I failed entirely to catch on to the very important cutting feature of the taps then spoken of.

This matter seems to have come up lately in the columns of the "American Machinist" in a shape that makes further dodging impossible. On September 2d there was a "suggestion in tap and die making," and an important one too, showing a tap with half the teeth cut away. It would probably be still further improved if half of those remaining were also cut away. Then on October 7th we were shown a new tap and die, in which, by a series of steps, the number of actual cutting teeth to the tap was still more reduced, to the advantage of the tap. On October 21st we have Mr. Green's interesting letter, before referred to, in which he tells about taking out half the teeth from the circular saw, and doing more work with less power and less wear.

Of course, we cannot go on reducing the number of teeth until they are all gone. The idea is, to give each tooth just enough to do; and that is precisely what we have not been doing with machine taps. With a single tool, and plenty of stock to cut, we generally, after a while, find out pretty near what it will do, and if we are built right we should be expected to keep the performance within sight of the possibility. If we had a V-groove to plane, 1-10 inch wide on the top, corresponding to the V-groove that we cut in a ¾-inch nut when we tap it, we could easily cut it, so far as the removing the metal is concerned, at one cut with a single tool, and with three cuts we could cut it as smooth and nice as anyone could desire. We have been taking 160 cuts or more to do the same cut with a ¾-inch machine tap, and nobody can tell us why.

The primitive way of cutting metal is with a single cutting point. The multiplication of cutting points is for increased accomplishment. With a tap, although we have several teeth cutting at once, they all have to traverse a single groove; so that if there are too many teeth, it is impossible to give them each enough to do. With milling cutters the case is very different. The milling cutter is adopted to accomplish more rapid cutting. When the best cutting speed is determined, it is a simple affair to get cut enough for each tooth by setting the proper feed. Who has done it? We hear to-day, as a wonder, of a certain shop where surfaces are milled with a feed of 6 inches per minute. If the cutter has a peripheral speed of 30 feet per minute, and it is probably considerably more than that, and if the teeth are a third of an inch apart, then the number of teeth that cut during that 6 inches of feed will be $30 \times 12 \times 3 = 1{,}080$, and the feed for each tooth will be $6 \div 1{,}080 = .005$ inch—one-half of one one-hundredth of an inch to a tooth. Nothing so wonderful about it, after all; the wonder would seem to be, rather, why the feed should not be a foot a minute, instead of 6 inches. When we first began milling, we used to make the teeth much finer or closer together than we do now, probably using three teeth where we now use one. We then went through the experience with those cutters that we are

just getting to with the taps. We found that by reducing the number of cutting teeth, using, say, only one-third the number, we could do more work and the teeth would stand better. The reason, obvious enough now, was that with the numerous teeth, no tooth had enough to do. With the milling cutter there was the remedy of enormously increasing the feed; but no one seems to have dared to do that. When we have put all the feed that is proper upon our present milling cutters, and we certainly have not nearly done it yet, there may be a tendency backward toward more numerous teeth, but not without increased feed to accompany them.

TECUMSEH SWIFT.

▲ ▲ ▲

Single Line Manufacturing.

Editor American Machinist:

It does not seem to me that "A Casual Observer" is altogether happy in his illustrations published in your issue of Oct. 7th. While no names are given, anyone familiar with the history of American machine shops cannot fail to recognize the second business referred to as that of the Brown & Sharpe Mfg. Co. While it is perfectly true that that company have a large line of products, it seems to me they are conspicuously not an illustration of a shop doing miscellaneous work. While their line is large, it is a line. A party wanting such machines as those built by this company, takes them as they stand on the warehouse floor, or else buys them elsewhere. If there is any concern in this country which does not cater to individual whims, but specializes its work and sells it as designed at home, it is conspicuously this one. The two opposite policies in machine construction are not those of making one product or several products, but they are the specializing of products, with the resulting system of manufacture which such specialization makes possible, against the making of almost anything which a customer may want, designing each machine for its work or to suit the customers' ideas. To put it in another way, the first system designs and builds the machine before it is sold, while the latter designs and builds it after it is sold, and of these two policies the Brown & Sharpe Mfg. Co. certainly represent the former. In a wider sense the former is the New England, while the latter is the Philadelphia policy, although, of course, houses can be found in each locality which follow the policy of the other to a greater or less extent.

C. O. GRIFFIN.

▲ ▲ ▲

Cheap and Quick Pipe Patterns.

Editor American Machinist:

When making pipes where only one or two castings are wanted, it costs more to make the pattern than you can get for the casting when finished. For the benefit of those who have such jobs, I will illustrate and explain a cheap and quick way to make a pipe pattern. We will call the casting 10 feet long, 16 inches outside and 14¼ inches inside. Find two boards, say, 1½ inches thick, 12 feet long and about 16½ or 17 inches wide. Dowell together as shown in Fig. 2; lay out by shrink rule, using ⅛ inch to the foot, and saw to lines as shown in Fig. 1. Saw out headers *B* 14 inches in diameter for core prints, and also headers 13¾ inches diameter for pattern; headers should be about 6 inches apart. Nail and glue to boards *A* as shown in Fig. 3. Nail braces *D* between each header. Then with large flat-head tacks put on cardboard ⅛ inch thick over

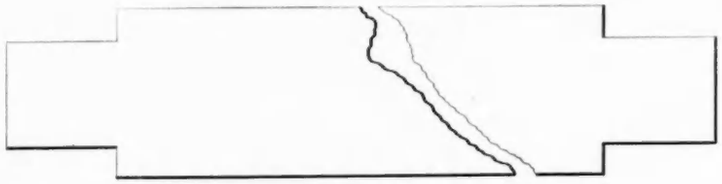


Fig. 1

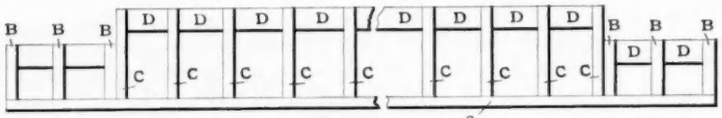


Fig. 3

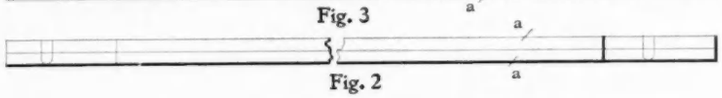


Fig. 2

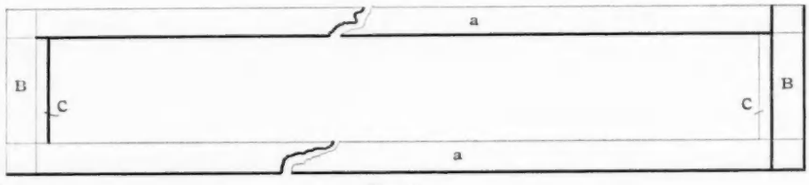


Fig. 4

Fig. 5

American Machinist

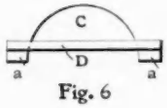


Fig. 6

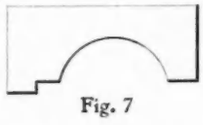


Fig. 7

A CHEAP PIPE PATTERN.

headers *B* and *C*. The cardboard comes in sheets and is sold by the pound. Cover with three or four coats of shellac, which makes it stiff and hard. If the molders use any care at all, the pattern will last for a number of castings.

In making the core box, make what is called a skeleton box (Figs. 4, 5, 6), then make a stuckle (Fig. 7). In Figs 4, 5, 6, strips *A* need not be more than 4 inches wide and 1 inch thick, strips *B* 2 inches thick and 4 inches wide, nailed and glued on top of strips *A*, as shown. Nail and glue heads *C* to strips *B*. Make what is called a stuckle ⅞ or 1 inch thick, as shown in Fig. 7, and you have the pattern made.

G. H. WILLARD.

Worcester, Mass.

The Springing of the Tool.

Editor American Machinist:

As long as we continue to make chips, and use lathe tools for that purpose, some of us will be thinking a little about what we are doing, and someone will have a word or two to say about it here and there, and so the discussion will be kept up. The springing of tools is one of the greatest annoyances to which we are subject, and it is therefore most provocative of discussion. The springing of tools has usually more effect in impairing the accuracy and finish of our work than in reducing our actual metal-removing or chip-making capacity. We have more trouble with light cuts than with heavy ones. On lathe work we have not only the actual springing of the tool to reckon with, but also the direction in which the springing occurs in relation to the curvature of the surface of the work. The same amount of spring, and in precisely the same direction, will have a much greater detrimental effect if the entire tool is high than if it is relatively low. Whatever the digging in of the tool, it may all be cured by lowering the tool. This action, of course, changes both the cutting and the clearance angles, reducing the former and increasing the latter, both effects being extremely bad. To remedy this, the tool needs only to be charged at the actual

point, while the body of the tool, or the part which is responsible for the springing, need not be changed. We do not in this way cure the springing, but we cure the digging in. We put the tool in stable, instead of in unstable equilibrium. The effect of the springing is simplified rather than reduced. The cutting point springs away until it is satisfied, and that is the last of it.

The trouble about the springing of lathe tools is, after all, a thing which, as mechanics, we rather ought to be ashamed of. We keep making lathes and planers heavier and heavier, until we have practically no spring to them, and then we are troubled nearly as much as ever with the springing of the tool itself. This, certainly, ought not to be. Is it not possible that we are still more or less hampered by tradition in the shapes of our tools, and especially in our modes of holding them. The English railroads have still the stage coach body very evident in the design of their passenger coaches, but not more so than we, both English and American, have in our lathe tools everywhere the survival of the tool of the hand lathe. The use of the rest for the tool was a necessity with the hand lathe, and the rest made the horizontal tool also the necessary thing. In designing the engine lathe, we have, first of all, retained the old name of "rest," and we have also retained and embodied the "rest" idea. The horizontal tool is no longer a necessity with the means which might now be provided for securely holding the tool.

Why would it not be a much more sensible idea to use lathe tools vertically? This would get rid of the springing of the tool, and it would also get rid of most of the forging or shaping of them. Square or triangular shapes of steel might be used, and any cutting angle might be given to them by the grinding of the ends to the angle required. The slight incline required for clearance in either direction below the point could be provided for in the tool holder. The end thrust of the tool under the cut might be successfully resisted by friction, or a block or screw might be provided under the end of it. I am aware that this suggestion is not a novel one, but I cannot help thinking that it is deserving of much more consideration and more actual trial than it has yet received. If the vertical tool is not a more sensible tool for common lathe work than the universally accepted horizontal tool, I would like to know the reason why.

MORRIS FULTON.

▲ ▲ ▲

Speeding Up by Arithmetic.

Editor American Machinist:

On a certain machine that they build in large quantities in the shop where I work, there are two sizes of gears that I bore and turn up. I have been doing these gears lately by "stent." The large ones I would do 2 an hour, and the small ones 3 an hour. There are five pairs of gears to a machine, and they build them in lots of half a dozen at a time. That takes 60 gears, and I would turn the 30 small gears in 10 hours and the 30 large gears in 15 hours, or 25 hours for the whole. When I took the last lot, the boss came to me, and he said I had better take them all in a lump. He said that 2 an hour of one kind and 3 an hour of the other kind made 5 in 2 hours, or 2½ in an hour, and that made it easier to figure. I said all right, and went to work; but I found that on that way of figuring I had to do the 60 gears in 24 hours. I managed to get them out all right, but what is troubling me is—what became of that other hour?

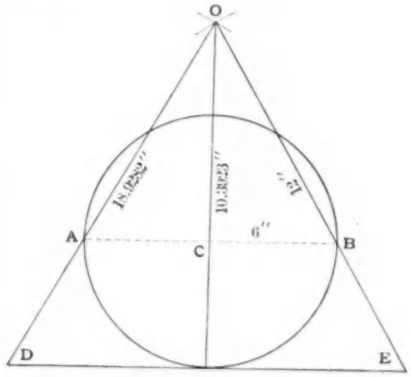
WILLIAM GREEN.

▲ ▲ ▲

The Circumference by Compass and Rule.

Editor American Machinist:

The construction shown in the sketch has been suggested to me by one, not so correct, which recently appeared in the "Wood Worker." It is a way of getting the length of a semi-circumference or circumference without figuring. Describe a circle of any desired diameter, and draw the diameter *A B*. From the points *A* and *B* with a length *A B* describe arcs



THE CIRCUMFERENCE WITHOUT ARITHMETIC.

locating the point *O*. Draw the base line *D E* of sufficient length, and then the lines *O D* and *O E*. The length of the line *O D* or *O E* will be equal to one-half of the circumference of the given circle, or the sum of the two will be equal to the entire circumference.

CYRUS T. BROWN.

St. Louis, Mo.

[The result obtained is not quite correct. Assume that the diameter of the circle is 12 inches. Then in the right-angle triangle *O C B* having the length of the hypothenuse and of the base, we find the length of the perpendicular *O C* to be 10.3923 inches. The length of *O F* and *O E* will be proportional to the lengths of *O C* and *O B*. That is:

$$10.3923 : 12 :: 16.3923 : 18.9282,$$

and

$$18.9282 \times 2 = 37.8564 \text{ inches.}$$

The actual circumference of a 12-inch circle being $12 \times 3.1416 = 37.6992$, the result obtained by the diagram is evidently slightly too great. The ratio is $37.8564 \div 37.6992 = 1.004$.—Ed.]

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Carborundum Powders.

Editor American Machinist:

We notice in your last issue an article on Laps, and in conclusion the writer stated that he had used carborundum with good results, but did not know that it could be obtained in as fine a grain as hand-washed emery. Carborundum is made and carried in stock in one, four, six, ten and fifteen minute hand-washed powders. These fine floated powders are prepared to meet the requirements of the lapidary, jewelry and optical trades, and are designated by the number of minutes they are suspended in water. Finer numbers than these above mentioned are prepared to order. These powders are used either wet or dry on lead, boxwood, ivory or bronze laps in the usual way.

COLCORD & SANDERSON.

St. Louis, Mo.

▲ ▲ ▲

Catching the Thread on the Lathe.

Editor American Machinist:

In your answer to "C. J. D.," in the issue of October 7th, you state the facts correctly and clearly; but would it not be well to tell the whole story, and say that the shortest distance the carriage can be moved and engage correctly is the least common multiple of the pitch of the lead screw and the thread to be cut? Of course, this brings in finding the least common multiple of two fractions, but a looking up of the old arithmetic will fix all that.

C. P. BENNS.

Teachers' College, New York.

▲ ▲ ▲

One Ton of Chips per Hour.

We have a pointer for our Australian correspondent who recently argued in our columns for four bolts to hold the lathe-tool. At a recent meeting of the Western Railway Club, Mr. Forsyth said: "I saw at the works of Hulse & Co., in Manchester, England, a large gun-lathe which had four tool posts, with a screw in the center, and they told me that each one of those tools would remove 500 pounds of steel per hour, so that the capacity of that lathe was the removal of one ton of steel an hour."

▲ ▲ ▲

We have received from the Philadelphia Commercial Museum a pamphlet, giving instructions for submitting samples and general information regarding the laboratory of tests and technology, to which we referred some weeks ago. This pamphlet, we understand, will be sent to anyone interested, upon application.

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British Representative.
R. E. Howard, 9 Leonard St., Finsbury, London, E. C.

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Space in advertising pages only is for sale.

We invite correspondence on subjects pertaining to machinery.

Name and address must always be given, though not necessarily published.

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The Safety of Elevators.

Several recent accidents to elevators have called special attention to them, and to the means employed to render them safe. The subject is one which must possess peculiar interest to the mechanical engineer, for the responsibility clearly belongs entirely with him. We believe that the elevator business is in most competent hands, and that the conditions of service, including safety, are as fully met in our best elevators as in any widely employed contrivance of man. Still, notwithstanding the millions of passengers carried, the occasional maiming, or the still rarer killing of a human being painfully and pungently assure us that the elevator is not absolutely safe, and leave it open to suggestion and criticism from all who are interested.

The accidents which occur should not be smoothed over, or made light of by any specious excuses. It may tend to reassure the passengers to tell them that the accidents seldom occur in regular passenger service. Many more are killed or injured who are in some way out of place or who are doing something improper in connection with the elevator or its appurtenances. So-called freight elevators are far more dangerous to life and limb than passenger elevators. The knowledge of these facts does not restore life nor reset broken legs. An accident of the same severity, if preventable, is equally to be guarded against wherever it may occur. Almost invariably, after the fact, the accident is shown to have been preventable.

There are various classes of elevator accidents, but the most characteristic and most serious, and that which we here have particularly in mind is the dropping of the cage. Of course, sufficient cable strength is always provided; still cables will break or let go, and then the safety devices come into play. It may be worth while to inquire whether the duty assigned to the safety catches, or the relation of their expected action to the regular operation of the elevator, is altogether the correct one. The safety catch is normally inoperative, and is designed to be put in operation by and for the emergency. Why should not these devices be rather normally operative instead of inoperative, so that, so to speak, their permission must first be secured by appropriate action before the elevator moves at all. The safety catches should be always on, and instantly efficient, except where they are deliberately, purposely and temporarily released to allow the cage to move.

The catches, clamps or brakes which are operated by a centrifugal governor may be theoretically all that could be desired, but in several instances of late they have demonstrated their practical inefficiency by failing to act at all, or not until a dangerous drop was accomplished. This may have been due to improper adjustment, but if so there should have been, and there should always be, some means of assurance as to that adjustment.

The air cushion at the bottom of the elevator shaft has repeatedly demonstrated its value as a saving device, and it would seem that it should be more generally, if not universally, employed. There is to be said for it, besides its efficiency when the emergency occurs, that it is always ready for business, and can scarcely be rendered inoperative, except by deliberate intention.

As to freight elevators it may almost be said that there are none. Men will ride when they can ride, and it is the fact that they do ride. The elevator runner usually rides in any case, so that practically every elevator is a passenger elevator. A notice conspicuously posted, warning all persons that they ride at their own risk, may relieve a proprietor of legal responsibility, but it still leaves the moral responsibility intact. It is not easy to see why a freight elevator should not be required to be made as safe as a passenger elevator. Certainly, in view of the fatalities which are constantly occurring with factory and storehouse elevators, they are not as safe as they should be.

The safety catches usually applied to freight elevators provide that if the cable breaks close to the carriage the dogs will be thrown out to engage in the racks at the side of the shaft. To demonstrate the reliability of the catches it is quite common to attach the cable temporarily to the carriage by a piece of rope, to haul the carriage, with a good load on it, up to the top of the shaft and cut the rope. Of course the catches work, the carriage does not drop, and the safety of the elevator is assumed. As a matter of fact, the cable has a persistent habit of not letting go in that way. If the cable breaks, as it usually does, much nearer the drum, if the drum gets loose on the shaft, if the teeth break out of a gear, or if something of that kind happens, the carriage may drop at very nearly full speed, while the drag of the cable will still be sufficient to overcome the springs and hold the dogs in. The dogs of this kind will not usually drop into the rack teeth, even if they get a chance to, after the carriage attains a high velocity. This so-called safety device has been so repeatedly proved to be worthless that it is time something better was employed. When the law requires some safety device, as it very properly should do, it should not be satisfied with this.

Elevators kill more people than steam boilers do, and the practice with them should certainly be not less carefully watched, and the regulations concerning them not less stringent, nor less strictly enforced.

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Labor-Saving Machinery and Its British Opponents.

An American who, in London, expressed the opinion that American workmen were superior to those of Great Britain partly because "unhampered by trade unionism," and John Burns, who lays the blame for Britain's industrial troubles chiefly upon British employers, whom he charges with being unprogressive and unenterprising, represent two diametrically opposed ideas held by many on both sides of the water and on both sides of the question.

We think, however, that most unprejudiced observers who really study the matter will be forced to conclude that whatever degree of conservatism there may be in Great Britain—whatever of aversion to doing new things or to doing old things in new ways may be observed there is by no means confined to any one class of the people.

A very little study of British engineering establishments will convince almost any one that the British workman and his

employer are at least as well fitted to each other as are the American workman and his employer, and to say that British employers would do better with American workmen, or that British engineering establishments would do better under American management is, we think, a mistake.

It is by no means the case that those British workmen who are "hampered by trade unionism" are less ambitious or valuable as workmen than those other workmen there who belong to no union. In fact, the opposite of this is clearly the fact of the case. The most hopeless, unenterprising, and least valuable British workmen are found among those who have no organization, and may be unable to form or maintain one.

The fact is that American labor and its employers have enjoyed the advantages of a new and rapidly developing country of almost limitless resources—a country in which there has been room enough and opportunity enough to stimulate ambition to the utmost limit. Just at the time when the American people had fairly gotten their formative governmental problems settled—had won their independence and were ready for their career as a nation, the results of the genius and the persistent labors of a British engineer, James Watt, became available in the various forms of the steam engine; by which man's capacity to do work was many times multiplied. This immense force, placed in the hands of Americans at this important period, just when it seemed to be most needed, has had a very different effect here from that produced by it anywhere else on earth. It has made our phenomenally rapid development possible, and combined with the advantages labor always enjoys in a new country, has multiplied opportunities and has secured for the workman that degree of respect and consideration which comes from the fact that opportunities to better himself have usually presented themselves to the intelligent and ambitious man.

It is not wise to deceive ourselves in this matter or to imagine that we are made of essentially different clay from the rest of the world, and a further plain fact is that with our rapid development we have, so to speak, aged rapidly; and there is no denying the fact that for the average man—he whom we are in the habit of referring to as belonging to "the masses" there is less and less of opportunity. Such a man, unable by reason of superior ability to force himself above the general level, finds here constantly less and less of opportunity for materially bettering his condition, and it is probable that we shall ultimately approach a condition which already prevailed in Great Britain before the advent of the steam engine as a productive force, and which prevented its being to the British workman the boon it has been to the American.

We believe the British workman makes a mistake when he resists the introduction of labor saving machinery or attempts to limit the benefits to be derived from it. We believe that all such efforts must in the end fail and injure most those who engage in them; but that is no reason why either we or our transatlantic cousins should blind ourselves to the plain facts or attribute difficulties to a mere superficial symptom, when in fact their cause lies much deeper.

There are, of course, large numbers of British employers who are ready to adopt new machinery and new methods; but to claim, as some of them do, that the opposition of the trades unions is the only retarding force in that direction, is absurd. The trade unions do undoubtedly stand in the way of improvement in shop methods; but we think practically every American machine builder who has been doing business in Great Britain during the past few years, will agree with us in saying that, while this retarding force of the unions may be powerful, it is by no means the sole cause of retardation, and one of the cold facts of the situation is, that there are engineering firms in Great Britain that have been putting in a good deal of American labor-saving machinery, and have had no difficulty whatever on account of it.

One of the tactical mistakes made by the British employer arises from his disposition to do thoroughly that which he undertakes to do, and to decline to be swerved a particle from his direct course. We all know that much of our labor-saving machinery derives its advantages from two circumstances; i. e., it will produce more work in a given time than can be done on a standard machine tool, and can be operated—in fact, is often the better for being operated—by men trained for that one thing only, and without a general all-round mechanical training. The British unions have insisted that such machinery must be operated by their members, receiving full union wages, and in view of the fact that, even when operated by such men, the machines will usually be a paying investment, it would seem to be good diplomacy, if nothing more, to put them in and operate them under those conditions, and await the opportunities which time usually presents of putting things upon their proper footing.

Automatic machinery can never do anything more than mere drudgery, and really good mechanics do not care to do such work. American mechanics have come to generally realize this, and the British workman would also realize it, probably, after a little experience with it.

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Several English publications have recently discovered that the American mile is 5,000 feet, instead of 5,280. The same discovery is not yet known in the United States; but they are using it over there in an attempt to discount some of our locomotive performances.

Technical Books.

BUCHANAN'S GEAR CHART. A Thoroughly Practical Treatise for the Design and Construction of Cog Wheels, for the use of Mechanical Draftsmen, Machine Designers, Pattern Makers and Machinists. Designed by L. A. Buchanan, M. E., San Francisco, Cal. 1897. Twelve pages, 11¾ x 7½ inches, and four blueprint charts, 15 x 11 inches. Price $1.

A practical work by a practical man. The charts exemplify all the usual problems occurring in gear practice. The proportional parts and diagrams are based upon a strength of material basis, and the manner of representing is believed to be original. Formulæ and principles of construction and uses of the diagrams are fully explained in every case. None of the diagrams represent mere rules of thumb, or even empirical formulæ, without reasonable scientific basis. The tables and constants given require only a knowledge of arithmetic necessary for the computation of any gear for a given power or pitch.

HOW TO BUILD A HOME. By Francis C. Moore. 58 5 x 7½-inch pages, with illustrations. Doubleday & McClure Company, New York. Price $1.00.

This book is intended for the information of those intending to build houses for themselves. It comprises suggestions as to safety from fire, safety to health, comfort, convenience, durability and economy, together with plans and sample specifications for all the various classes of work entering into a dwelling house. It is a piece of art printing on superior paper and is bound in very novel and appropriate style in wood.

"Annuaire Général de la Velocipedie de l,Automomolie et Industries Qui s'y Rattachent, 1897 (General Directory of the Bicycle, Horseless Carriage and Allied Industries). 957 4¾ x 7-inch pages. F. Thevin & Ch. Houry, 24 Rue de Louvre, Paris, France. This publication gives a list of the leading bicycle and horseless carriage makers throughout the world. It is, of course, in the French language.

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Personal.

We will consider it as a favor if our readers will send in items of news regarding changes of foremen, superintendents or others prominently connected with the machine business. Such items are legitimate news of the trade, and we are glad to make room for them.

Assistant Engineer C. R. Emrich, U. S. N., is ordered to duty at Norfolk, Va.

Mr. Charles A. Moore, of the firm of Manning, Maxwell & Moore, this city, has been made a member of the executive committee of the National Association of Manufacturers of the United States.

Prof. Jas. M. Crafts, who has been at the head of the department of chemistry at Massachusetts Institute of Technology, will succeed the late Gen. Francis A. Walker as President of the Institute.

Mr. C. A. Robinson, superintendent of the Bell Electric Company of New York,

has retired, and Mr. W. H. Reade, the general foreman, appointed in his place. Mr. A. L. Jones has been appointed general foreman.

Our correspondent, Charles L. Griffin, M.E., has been appointed assistant professor of machine design at the Pennsylvania State College, and will have full charge of shaping the course in machine design.

Mr. F. H. Stillman, of Watson & Stillman, was a passenger on the ill-fated train which was wrecked near Garrisons station of the Hudson River Railroad, the morning of October 24th. Mr. Stillman saved his life by swimming ashore.

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On Oct. 14th, on the South Jersey Railroad, the Holman friction-geared locomotive made a mile in 42 seconds and a run of 54½ miles in 52½ minutes, which, however, does not prove it to be a safe or practicable contrivance.

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An esteemed contemporary in a pessimistic editorial speaks of "breeches between capital and labor." If they have but one pair of breeches between them they certainly are in a bad way.

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George M. Pullman.

One of America's most prominent manufacturers, Geo. M. Pullman, died suddenly of heart disease on the 5th inst. He had amassed a colossal (though variously estimated) fortune and did it by perfectly legitimate means. That is to say, he was not only an inventor, but he was also an exceptionally able business man and he supplied to the public something which, while not an absolute necessity, is yet of such utility and convenience as to induce people generally to pay the price charged rather than go without it: while the influence and example afforded by the luxurious cars built by him have, no doubt, contributed much to the comfort and pleasure of those who for various reasons do not ride in Pullman cars.

From the starting of the enterprise the "American Machinist" has maintained that the town of Pullman scheme was a foredoomed failure, and we believe it has proven so. As a business enterprise it is probably successful, but we believe it has been made so only because it has become a part of Chicago and because much of the paternalism has been knocked out of it by hard experience.

It has always been our belief that American citizens need to exercise the full duties of American citizenship in order to make and keep themselves worthy of it.

Though successful, broadly speaking, it is yet known that some departments of Pullman's business were not always well managed, and he has not always been fortunate in the selection of his associates.

What may be called the machine shop side of the business has at times been notoriously poorly managed and there have been officers of the company who have not hesitated to advance their own interests and gain favor with Pullman by methods no honorable man would resort to. One of Pullman's limitations as a manager is shown by the fact that such methods appeared to be successful.

The deep and perhaps far-reaching problem, yet unsettled, regarding the invasion of the constitutional right of trial by jury may be said to have been first squarely presented by difficulties growing out of a dispute between Pullman and his employés; a dispute in which he stood strictly upon his legal rights, but did not gain the general approval of those who believe that American citizenship imposes other obligations than being merely within the law. At the same time it is probable that Pullman has been blamed with a good deal that of right should be charged to others.

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A Cheap Underground Pipe.

A plan for constructing an underground pipe that is not to be subjected to great pressure, has been employed in France, with satisfactory results. A trench is dug, and the bottom leveled with cement mortar. An inflated rubber tube covered with canvas is then laid in, and cement is poured around and over it. The trench is then filled in, and the tube deflated and withdrawn. It is said that 6-inch pipes have been made of hydraulic lime and sand at a cost of 22 cents per yard. This style of pipe might sometime be the thing to try for a wind pipe to a cupola.

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The Dynamics of Baseball.

An interesting question in dynamics is suggested in connection with the national game. The force of the stroke and all other particulars being equal, will a slow-pitched ball or a swift ball be batted to the greater distance? The question suggests two rather contradictory answers. A portion of the force of the stroke must of course be lost in the stoppage of the ball, and as the swift ball must require more force to stop it than the slow ball there will be less surplus force remaining to impel the ball in the opposite direction when the swift ball has been stopped, and consequently the swift-pitched ball will not be batted as far as the slow ball. It is further stated in argument that a batter who tosses up his own ball and then strikes it will knock it to a greater distance than is done in games with a regularly pitched ball.

On the other hand, it is argued that the elastic reaction of the ball itself is the ultimate force which impels it, and as the swift-pitched ball must be more compressed than the slow one by the same blow, it must also be impelled by the greater force when the elasticity of the ball reasserts itself, and the swift-pitched ball must therefore be knocked further than the slow ball. The fact that a standing batter can knock a ball of his own tossing further is, if true, no argument in the case, as he, of course, hits the ball more squarely and favorably and under different conditions. The elasticity of both ball and bat seem to be important factors in the case, and these in practice may be so different as in some cases to favor one line of argument and in some cases the other.

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Explanations Requiring Explanation

Explanations should explain. If the explanations themselves need explanation, their work is only half done, and without the supplementary explanation they may lead directly to error instead of to the truth. Writers upon mechanical topics cannot be too careful and precise in their statements. An esteemed contemporary in whose columns we often find valuable information not directly in our own line, and generally clearly and tersely stated, recently had a contributed article on slipping belts, in which the following information (?) is given:

"There are still some mechanics, as well as others, who say that a belt slips because the pulleys are too small. This is an error, as belts will slip as readily on large pulleys as on small ones, providing, of course, that the pulleys are not excessively small. A belt may slip on small pulleys and hold firmly on larger pulleys, while doing the same work, but it is not because one pair of pulleys is small and the other pair large, but rather because the velocity of the belt is greater on the large pulleys. A belt transmits power in proportion to its velocity. Thus, a belt having a velocity of 2,000 feet per minute will transmit twice the power that it would at a velocity of 1,000 feet per minute. The slipping of a belt on small pulleys can be stopped by increasing the speed of the shafts, thus increasing the velocity of the belt. This, however, is not a practical remedy, as it increases the speed of the machinery, which is generally not permissible. The proper way, therefore, to increase the velocity of a belt is to use larger pulleys."

Belts slip because they don't stick. The slipping may be cured either by increasing the adhesion or by decreasing the pull. By doubling the diameters of both driving and driven pulleys, every other condition being unchanged, a previously slipping belt may be made to run all right. The speed of the belt will be doubled, but the pull on the belt will be reduced one-half, and the slipping will actually be cured, not by the increased velocity, but by the reduction of the pull, although this would not be gathered from the paragraph quoted above. When a belt is slipping, it is apt to slip more, rather than less, if the speed of the driver is increased. It of course is not true that "the slipping

of a belt on small pulleys can be stopped by increasing the speed of the shafts," that is by speeding up the entire system and making no other changes, as the statement might be taken to mean.

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American Railways in 1896.

According to a recently issued report of the Interstate Commerce Commission, the total railway mileage in the United States on June 30, 1896, was 182,776.63 miles, there being an increase of 2,119.16 miles, or 1.17 per cent. during the year. This does not include cars owned by private companies, but used by railways in the transportation of freight.

The total number of locomotives in service on June 30, 1896, was 35,950, or 251 more than on the same date of the preceding year. Of this number 9,943 were passenger locomotives, 20,351 were freight locomotives, 5,161 were switching locomotives, and 495 were unclassified. The number of cars of all classes in service was 1,297,649, including an increase of 27,088 cars during the year ending June 30, 1896. The number of cars assigned to the freight service increased 25,768, being 1,211,887.

The number of men employed by the railways of the United States on June 30, 1896, shows an increase of 41,586, being 826,620, which, assigned on a mileage basis, gives 454 men per 100 miles of line. The corresponding figures for the year ending June 30, 1893, were 873,602 and 515. The assignment of employés corresponding to the four main divisions of the classification of operating expenses were as follows: General administration, 31,792; maintenance of way and structures, 243,627; maintenance of equipment, 167,850; conducting transportation, 373,747; unclassified, 9,609.

The number of passengers carried during the year ending June 30, 1896, was 511,772,737, being an increase of 4,351,375 as compared with the year ending June 30, 1895. That year, however, showed a decrease of 33,266,837 as compared with 1894. The number of passengers carried one mile during the year was 13,049,007,233, showing an increase as compared with the previous year of 860,560,962. The corresponding decrease of the year 1894 was 2,100,999,622. The number of passengers carried one mile per mile of line—that is, the figures indicating the density of passenger traffic during the year ending June 30, 1896—was 71,705, an increase of 3,133 in this item being shown. The corresponding decrease as shown by the report of 1895 was 12,761. The number of tons of freight carried during the year under consideration was 765,891,385. This is the largest tonnage ever reported for railways in the United States. The increase during the year was 69,130,214. The number of tons of freight carried one mile was 95,328,360,278, there being an increase of 10,100,844,387. The density of freight traffic is shown by the number of tons of freight carried one mile per mile of line, which was 523,832. These figures, as compared with those of the preceding year, show an increase of 44,342 ton-miles per mile of line.

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Commercial Review.

NEW YORK, Saturday Evening, Oct. 23.

MACHINE TOOLS.

The sum total of market conditions is such as to justify continued confidence, tempered by a little conservatism. Trade journals making a specialty of the iron market acknowledged this week that demand had considerably lessened. The two principal commercial agencies report the same of business generally, but not with a pessimistic emphasis.

In the particular domain of machine tools we find evidence of the gigantic strides trade has been making in the last few months, but accompanied in some quarters by signs that the present one has seen a little retrogression. As to this point, however, there is a radical difference of opinion among the trade. The truth of the matter apparently is that in this region the demand upon many sellers has not been quite so active during October as it was a few weeks earlier, and as far as New York, at least, is concerned, politics may in part be to blame.

But business exhibits many encouraging features, nevertheless, and many of the machine-tool sellers are happy over it.

THE HOME MARKET.

One of those who does business upon the largest scale remarked to us: "Sales of small or medium-sized tools, that is, 16-inch lathes, for instance, have manifestly increased. For heavy tools there is beginning to be an inquiry somewhat improved. Although the Eastern tool market has shown a little slackening the conditions in the West are excellent. Take, by way of example, Nebraska, where the heavy crops have enabled them to pay off so many million dollars' worth of debts. This does not mean, however, that Western railroads comprise the purchasers of what heavy machinery is at present being sold. They are not yet quite ready to buy. They had their shops well stocked up before the depression and have not yet reached the point where it is necessary to replenish their stock. The class of customers to whom we look for orders for heavy machinery are the large shops, in whatever part of the country they may be located, to whom big cranes and other big machines are becoming more of a necessity than they used to be. Some engine builders, for instance, want them in building tools for themselves. What is needed now is a machine which will take off just as much metal as possible, and do it accurately."

THE FOREIGN MARKET.

Our informant remarked, moreover, that his export trade was good. He had, the day before, sold two thirty-ton cranes which, we believe, were for the foreign market. Several other parties spoke in favorable terms of the market abroad. One company is to equip a certain shop which will probably require about forty machines in all. Another has received a large order to supply a bicycle plant. Both of these are wished to be preserved strictly private, and therefore further particulars cannot be given. A third concern has received an export order for five tools within a day or two.

A representative of a New England company says: "About two-thirds of our trade is foreign. The main current of it seems to flow to Germany, although we have lately made a good shipment to London. Our English agent writes that the engineers' strike, up to the present time seems to have benefited the demand for American tools, but that it is questionable how long this satisfactory effect will continue. There is a limited number of men in England who are willing to use American tools." So he seems to think that the delicate digestive organs of John Bull will stand only a definite amount of American machinery without rebellion.

A TINGE OF CONSERVATISM.

A local machinery dealer just returned from a New England trip reports that traveling men encountered still talk of quietude in trade, and that the factories are not yet very active, though looking forward to more work.

HEAVY CORRESPONDENCE.

It has been remarked to us by two different parties independently that they are now occupied with an unusually large amount of clerical work; that is, answering letters, estimating upon special machines, etc. Part of it is due to foreign correspondence, it being charged that the European business men use more ink than is necessary.

THE BARGAIN COUNTER.

Low prices are still complained of. One concern informs us that it has this week turned away a contract for eleven tools, which certainly it could have received had it bid low enough, and allowed the same to go to a rival company, just on account of price. In an office across the street a similar tale is told. There an order for three tools and another for one tool have just been allowed to go for the same reason. "It seems to be thought by buyers," says the latter party, "that on account of the hard times we have been going through, manufacturers will have to make just what concessions are asked for. But on the other hand, manufacturers such as ourselves feel that we can now afford to keep the tools for the future rather than sacrifice a dollar on them. Every machine that now goes through our shop is ordered and we are working with nearly a full complement of men."

A certain company in town has the reputation of being a perfect Weyler in its butchery of prices. Recently it chopped off $500 on three tools with a single stroke of the cleaver.

A FEW FAVORABLE REPORTS IN CLOSING.

The New York office of one of the largest machine tool companies in the Eastern States is unprecedentedly busy, and other branches of the same company, situated

(Continued on page 37.)

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Pattern Castings. H. D. Phelps, Ansonia, Conn.

Dies & Die Mak'g, $1. J. L. Lucas, Providence, R.I.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Cost of Manufacturing—Experienced manager will establish system of costs, giving exact account of every detail. Charge based on saving effected. Correspondence solicited. Geo. C. Thomas, 99 Nassau Street, New York, Room 212.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

By A1 machinist Monroe, 405 Sharp, Balto., Md.

Pos. wanted by a young man as an iron molder; Eastern States pref.; ref. given. Box 62, AM. MACH.

Pattern maker wants a pos.; exp. in mch. tools, engine works, gears; accurate. Box 60, AM. MACH.

Job to earn living in high alt.; West; 4 yrs shop; 1 year drafting; tech. grad. Box 56, AM. MACHINIST.

Wanted position by first-class toolmaker or machinist; A1 refs.; good worker. Box 54, AM. MACH.

Pos. wanted by an experienced mech. engineer; specialty wood-working mchy. Box 50, AM. MACH.

Graduate M. E., some shop experience, 4 years superintendent light manufacturing plant desires position. Box 45, AMERICAN MACHINIST.

Tool maker, used to grinding machines, hardening, close measurements, all-round machinist, wants position. Box 46, AMERICAN MACHINIST.

Wanted—Position by draftsman experienced on special mchy and tools and perfecting inventor's ideas; A1 refs. Add. 392 Douglas St., Brooklyn, N.Y.

Wanted—Position as chief engineer to foreign country. Take 3 or 5 year contract. Experienced in erecting and handling men. Box 53, AM. MACH.

Correspond'e wanted with firm des. trav. engr. to handle wtr. whl. plants, pr. trans. mch. & elec. ap.; varied exp., drf. rm., shop & ins. Box 57, AM. MACH.

If you want a pushing supt. or general foreman, with wide experience in modern shop methods, engines general and heavy machinery, etc., address J. L. Hummer, No. 525 Tallman St., Syracuse, N. Y.

Mech. engr., 40, with exp. as mach., chief engr., erec. engr., hea draughtsman and supt. on steam engines, ice machines, team pumps, Corliss pump. engines, general mchy, installations, estimating and soliciting; 10 yrs shop and 12 yrs office experience; best of references. Address "Hustler," AM. MACH.

An active, practical mechanic having extensive experience in the handling of foundries, machine shops, etc., in electrical, power transmitting and various other lines, desires a position as superintendent or manager. Would prefer a pe centage of the profits, or will take an interest as a partner. Address Box 39, AMERICAN MACHINIST.

Mechanical engineer, with extensive experience as superintendent and manager of large machine works, is open to engagement. Stationary and marine engines, boilers, foundry work, gearing and general machinery. Can manage shops, engineering department, estimate or solicit. Best of references. Address Box 33, AMERICAN MACHINIST.

Help Wanted.

Wanted—Draftsman familiar with printing machinery. Box 52, AMERICAN MACHINIST.

Wanted—Draughtsman, eng. and general work; good designer. Robt. Wetherill & Co., Chester, Pa.

Wanted—A moulder to take charge of foundry; give age, experience and nativity. Phoenix Iron Works, Port Huron, Mich.

Young man as helper on steel heating furnace. Address, stating experience and wages expected, Box 51, care AMERICAN MACHINIST.

A reliable hammer-smith, experienced in operating Bradley helve hammer on light work, can obtain permanent sit.; West Conn. Box 48, AMER. MACH.

Wanted—A man exp in light, accurate experi. work. Must also be a good toolmaker. Per. pos. to right man. Address, with refs., Box 58, AM. MACH.

Wanted—Foreman for toolroom; one who has had exp. on fine, accurate interchangeable work. Must furnish best of refs. Address Box 59, AM. MACH.

Wanted—Strictly first-class all-around die maker, who is competent to act as foreman and can lay out and design all kinds of dies. State experience, age and where last employed. Box 61, AM. MACH.

Wanted—As chief engr. for a large plant a thor. comp. American, able to run steam, elec. light and power plants, ice and refrig. plants. Must be able to attend himself to all fitting and repairing. Address, stating age, terms and exp., "Electric," AM. MACH.

▲ ▲ ▲

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O

Calipers & Gauges. F. A. Welles, Milwaukee, Wis

Caliper Steel, 6 Prs., assorted; mailed $1; finest stock. Box 61, 96 Park Row, N. Y.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Mach. and engr. des. to invest money and services in estab. engine building works. Box 55, AM. MACH.

Light and fine mach'y to order; models and elec trical work specialty. E. O. Chase, Newark, N. J

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middle town Machine Co., Middletown, Ohio.

For Sale—Small machine shop, having good repair trade, in town of 14,000 inhabitants; no opposition. Box 42, AMERICAN MACHINIST.

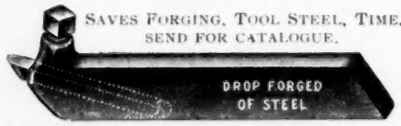
Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

Wanted to mfr for responsible parties articles in metal in large quantities, either on royalty or by contract. Address Boyer & Radford, General Machinists, Toolmakers and Die Sinkers, Dayton, O.

A young married man, with considerable means, wishes to associate himself with a machine or mfg. con ern where he can apply his financial and office ability. State particulars and number of men employed. "German-American," care AM. MACHINIST.

ARMSTRONG LATHE AND PLANER TOOL.

SAVES FORGING, TOOL STEEL, TIME. SEND FOR CATALOGUE.



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WM. B. FRANKLIN, Vice-President.
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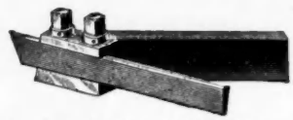
J. B. PIERCE, Secretary and Treasurer.



HUGH HILL TOOL CO.,

See last week's issue. Anderson, Ind.

Columbia University
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SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.

Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.

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The only American book on an interesting subject. 279 large pages, 8vo, illustrated with 206 handsome engravings. **$2.50** prepaid to any address.

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NORMAN W. HENLEY & CO.,
15 Beekman Street, New York.

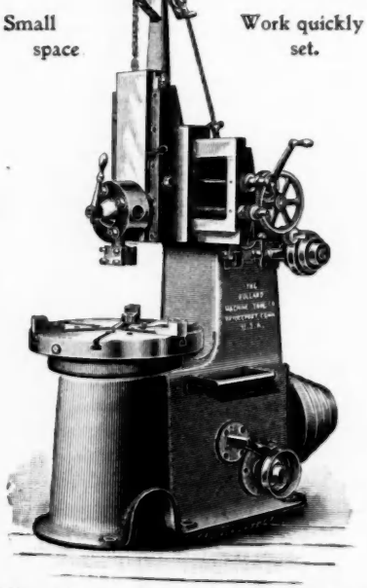
A Turret

MILL

is sometimes better than a lathe.

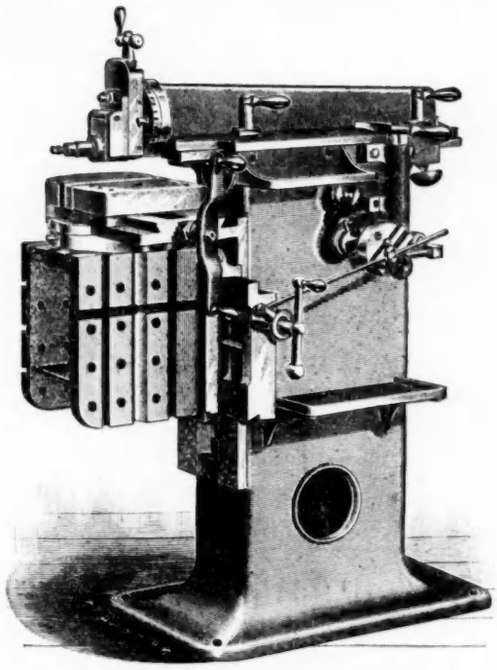
Small space

Work quickly set.



We make a specialty of reducing the cost and improving the product where duplicate parts must be bored, turned, faced or threaded.

BULLARD MACHINE TOOL CO.
BRIDGEPORT, CONN.



. . IMPROVED . .

15-inch Hendey Shaper.

Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

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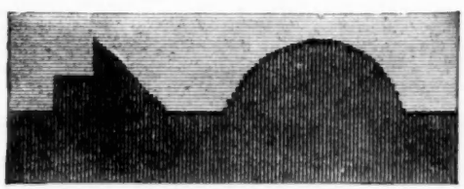
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

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THE HENDEY MACHINE CO.

TORRINGTON, CONN.

Agents for the Pacific Coast—PACIFIC TOOL AND SUPPLY COMPANY, San Francisco, Cal.

European Agents, { SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels, Stockholm.
CHAS. CHURCHILL & CO., Ltd., London, and Birmingham, Eng.
ADPHE. JANSSENS, Paris, France.
EUGEN SOLLER, Basel, Switzerland.

(*Continued from page 36.*)

at Boston and Chicago, are also experiencing an active trade.

The local office of one of the best known concerns in the West reports an increasingly heavy export trade, a large part of which is for Russia. The foreign market absorbs so many large tools that it is almost impossible to supply home customers with them, and recently a contract for some 28-inch lathes had to be turned away because it was impossible to furnish the machinery. This office is obtaining good orders from Buffalo, N. Y., and vicinity.

Electrical machinery manufactures are good customers in the tool market at present. To replace those in an electrical factory which burned down some time ago, contracts are being given out which will be for about twenty machines.

Quotations.

NEW YORK, Monday, October 25.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 00
No. 2 foundry, Northern	11 25 @ 11 50
No. 2 plain, Northern	10 75 @ 11 00
Gray forge, Northern	10 50 @ 10 75
No. 1 foundry, Southern	11 00 @ 11 25
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 25 @ 10 75
No. 1 soft, Southern	11 00 @ 11 25
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, or No. 4, South'n	10 00 @ 10 25

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.50 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2½c. The range of base sizes has been changed from 1 @ 3 inch, to 1 7-16 @ 3 inch.

Copper—Carload lots, Lake Superior ingot, 11⅛ @ 11¼c.; electrolytic, 10⅞ @ 11c.; casting copper, 10⅝ @ 10¾c.

Pig Lead—Carload lots, 3.92½ @ 3.95c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.90c., f. o. b.

Spelter — Carload lots, 4.20 @ 4.25c., New York delivery.

Antimony—About 7.85c. and upwards for Cookson's; 7.25c. and up for Hallett's.

Lard Oil—Prime City, ice pressed, ordinary quality, in wholesale lots, about 40c.

▲ ▲ ▲

Manufactures.

The Danversport Rubber Works, Danvers, Mass., will be rebuilt.

The Fowler Cycle Company, makers of the "Fowler" bicycle, has failed.

At Bedford, Ind., John R. Walsh, of Chicago, is to erect a stone sawmill.

Work on the new Monarch Mills at Hutchinson, Kan., is progressing rapidly.

At Montpelier, Vt., George Banister is building an addition to his machine shop.

The town of Hanna, La., is considering the advisability of installing an electric-light system.

At Barnesville, Ga., George McRea, of Brunswick, Ga., will erect a foundry and machine shop.

The Smith & Dove Manufacturing Company, Andover, Mass., is making extensive repairs upon its plant.

The new mill of the Jackson Manufacturing Company, at Nashua, N. H., is under course of construction.

The new tin mill at the La Belle, W. Va., is being constructed as rapidly as the circumstances will permit.

George H. McNeely & Co., of Philadelphia,

Pa., will erect a morocco factory. It will measure 153 x 205 feet.

The Hull-Beck Manufacturing Company's plant at Shelby, O., will be pushed to completion as soon as possible.

The Geiser Manufacturing Company, Waynesboro, Pa., is building a new one-story annex to its foundry, 38 x 70 feet.

The Oriental Manufacturing Company, of Philadelphia, Pa., expect to build a factory, which will be 50 x 150 feet.

The Laughlin Mill Company has purchased a site and started the erection of a new tin plate plant at Martin's Ferry, O.

Brady, Beatty & Co., Washington, Pa., who now operate three glass factories, will build another plant, to employ 100 men.

At Sedalia, Mo., the Missouri Pacific (Ky.) Company will erect a corrugated iron building, 700 x 45 feet, to cost about $47,000.

It is expected that work on Frank Wheeler & Son's new brick machine shop on Stone street, Meriden, Conn., will soon be commenced.

The big galvanizing plant being erected by the Struthers Iron & Steel Company, Youngstown, O., is well under way, and will soon be finished.

Fire badly damaged the planing mill of W. E. Bush, Lexington, Ky., recently. The boiler-room and quite a lot of the machinery were destroyed.

At Adams, Mass., work on the new foundry of James A. Allen is progressing nicely. The building will be 41 x 87 feet, and will also contain a machine shop.

Baxter Molding Company, St. Louis, Mo., has been incorporated; capital stock, $40,000. C. O. Baxter, Charles Ortman and H. Naffz are the incorporators.

The McAlister Machine Gun Company, of Memphis, Tenn., has been incorporated. The incorporators are W. J. Crawford, A. H. McAlister, R. I. Long, etc.

The Cleveland Gear Works, Cleveland, O., is the name of a new company, the proprietor of which is George B. Grant, with William R. Sawyer as superintendent.

At Syracuse, N. Y., the Economy Foundry & Machine Company has been incorporated. The directors are Slater Laycock, F. A. Austin and William H. Brown.

The Illinois Central Railroad Company will erect a one-story brick boiler-house on the east side of Indiana avenue and Fourteenth street, Chicago, Ill., to cost $6,000.

At Bristol, Pa., William H. Grundy & Co. are to erect a woolen mill, 55 x 317 feet, which, when completed, will be equipped with modern woolen manufacturing machinery.

Plattsburg Foundry & Machine Company, of Plattsburg, N. Y., has been incorporated. Directors: Sidney S. Whittlesey, John Ross and John M. Wever, of Plattsburg.

The Buffalo Forge Company, Buffalo, N. Y., have received orders for the fans and engines required for torpedo boats Nos. 12 and 13. Four blowers are required for the installation.

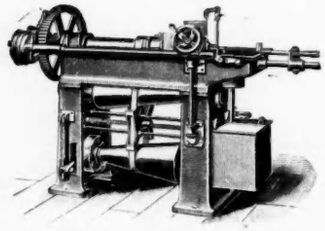
The Marsh Plate Glass Company, Monongahela, Pa., will double the size of its plant at Walton's Station. The company has also purchased the O'Leary glass house at Blair Station.

The Colorado Fuel & Iron Company contemplate building an addition to their plant at Pueblo, Col. The addition is for the purpose of manufacturing structural sheet and bar steel.

The Cleveland Machine & Forging Company, newly incorporated, has taken the plant of the Ajax Manufacturing Company, at Glenville, O., and will immediately begin operations.

CUTTING-OFF LATHES

With automatic feed and stop motion, in four sizes, for ¼ to 4½ inch diameters, without and with mechanism for quickening motion of the spindle and feed as the tool advances toward the center of the work.



2 SPINDLE CENTERING MACHINES, in 2 sizes.

SHAFT DRILLING AND GEAR CUTTING given special attention.

Ask for the Machinists' Catalogue.

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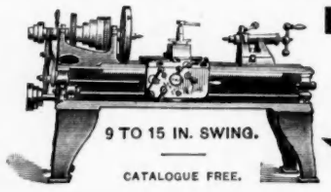
NEW YORK: 123 Liberty St. BOSTON: 144 Pearl St. CHICAGO: 42 South Clinton St. LONDON, England: Buck & Hickman, 280 Whitechapel Road. PARIS, France: Fenwick Freres & Co., 21 Rue Martel.



Lathes! Planers!! Shapers, &c.!!!

Our tools are all of the latest and most approved designs, while the workmanship, material and finish are of the highest order. You will find it an advantage to have our catalogue and special prices before placing your order.

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Heating and Ventilating Buildings.

By R. C. CARPENTER.

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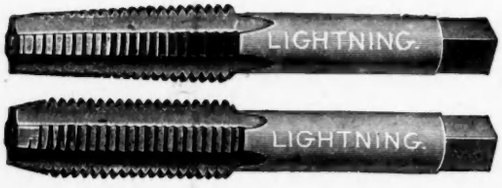

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Machine Relieved Taps.

ALSO DIES, SCREW PLATES, REAMERS, Etc.

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Foot Power Screw Cutting, Automatic Cross Feed, 9 and 11" Swing.

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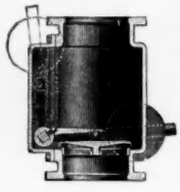
Seneca Falls Mfg. Co.

697 Water St., Seneca Falls, N.Y.



Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments

JENKINS BROTHERS, New York, Boston, Philadelphia, Chicago.

Die and Tool Steel.

NO BETTER MADE.

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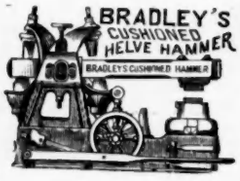

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